INTERSECTIONS

Friday, 04.21.2017
in conjunction with Research ShowCASE
All Abstracts For Scientific Review

Research ShowCASE Abstract Report

Group:

Full Abstract Report
Glutathione (GSH) is an important antioxidant that protects lens protein from damage and can cause cataracts to form. With age, our lenses lose GSH and become susceptible to cataract formation. To better understand how the lens reacts to this loss of GSH, we studied the RNA changes that occur in mice lenses with low levels of GSH. We found that lenses with low levels of GSH increase their levels of other antioxidants and detoxifying genes to protect from damage. Additionally, low GSH caused lenses to...
Heart Rate Variability Biofeedback in Grandmothers: Evaluation of Intervention Parameters

Problem statement: Heart rate variability (HRV) biofeedback is known to reduce stress through slow, paced breathing synchronized with heart rate to achieve coherence: it is effective for persons who face daily, ongoing stress. Studies of HRV biofeedback in grandmothers raising grandchildren show lower stress, fewer negative emotions and cognitions, and higher coherence scores. However, it is critical to evaluate this intervention from the user’s perspective. Theoretical framework: Zauszniewski’s (2012) Conceptual Model for Evaluating Interventions defines the six parameters examined in this study: necessity, acceptability, feasibility, fidelity, safety, and effectiveness. Methods and design. For this secondary data analysis, we used a descriptive design with a convenience sample of 20 grandmother caregivers who used HRV biofeedback for four weeks to identify trends and themes from their responses to open-ended questions to assess the six intervention parameters post-biofeedback. Results. We found 80% of the grandmothers believed they needed biofeedback; 90% said that others like them would need it; 25% had limited interest in doing biofeedback; 45% said it was challenging; 15% said it was uncomfortable for them. Yet, 95% reported they successfully learned how to breathe to achieve coherence; 45% said the biofeedback was the most helpful part of the study. Implications for practice: Our findings indicate generally positive evaluations of the intervention parameters and support the use of HRV biofeedback for stress reduction in grandmother caregivers, which may have broader application in clinical practice. Implications for future research: Relative to the six intervention parameters, our findings provide essential knowledge for moving forward into larger, randomized controlled trials examining the effects of HRV biofeedback in grandmother and other family caregiver populations.
The Cleveland FES Center is a consortium of the Louis Stokes Cleveland VA Medical Center, Case Western Reserve University, MetroHealth Medical Center, and University Hospitals. Researchers, engineers and clinicians work together to develop patient-centric solutions that enable the translation of neuro-technology applications into clinical deployment. www.FEScenter.org

The Cleveland FES Center is a consortium of three nationally recognized institutions: Louis Stokes Cleveland VA Medical Center, Case Western Reserve University, MetroHealth Medical Center and University Hospitals. With the support of these partners, the Cleveland FES Center is able to be at the forefront of academic and clinical research, furthering the advancement of neural technology into clinical standards of care. The Cleveland FES Center strives to create an inquisitive and collaborative environment from which researchers, engineers and clinicians work in a unique alliance to develop innovative, patient-centric solutions that improve the quality of life of individuals with neurological or other muscular skeletal impairments. Through the use of neurostimulation and neuromodulation research and applications, the Cleveland FES Center leads the translation of this technology into clinical deployment. www.FEScenter.org
Hematopoietic stem cells (HSCs) are cells isolated from the blood and bone marrow that can 1) self-renew, 2) differentiate into multiple cell types, 3) mobilize out of the bone marrow into circulating blood, and 4) undergo programmed cell death. HSCs are continuously exposed to internal and external stresses that threaten the integrity of the cell, and accumulation of damage can lead to genomic instability. Genomic instability is of concern during space travel where astronauts are exposed to potent sources of ionizing radiation, namely Galactic Cosmic Radiation (GCR) consisting of high energy and charged atomic nuclei. Recent data from our group has demonstrated that middle-aged individuals show frequent defects in DNA mismatch repair (MMR) in HSCs. Therefore, we hypothesized that high-LET radiation characteristic of the GCR that will confront astronauts on space missions will damage HSCs and contribute to induction and progression of hematopoietic malignancies. To study this hypothesis, we employed a DNA mismatch repair deficient mouse model (Mlh1+/-) to study the effects of different radiation sources including 56Fe, 28Si, 4He, 1H and ?-rays on HSCs of potential astronaut population under GCR conditions. In vitro colony forming unit assays showed that HSC survival decreases with increasing dose of radiation, but not depending on Mlh1 status. The complete blood count (CBC) data after 5 months and 9 months of whole body irradiation with different ions showed a slight dose-dependent decrease in all blood counts but again an absence of any significant difference in CBC of Mlh1+/+ vs Mlh1+/- mice. However, whole body 0.1 and 1 Gy 56Fe-ion irradiation in Mlh1+/- mice showed a significant higher incidence of tumorigenesis compared to gamma irradiated and un-irradiated Mlh1+/- mice. Thus, the data show that MMR defects in HSCs leads to sensitization to radiation induced hematopoietic malignancy, and that radiation quality effects exacerbate the sensitivity.
The APT Center develops technical interventions that serve the clinical needs of veterans with motor and sensory deficits and limb loss.

Abstract

The Advanced Platform Technology (APT) Center is a Department of Veteran's Affairs Center of Excellence for Rehabilitation Research and Development. In partnership with Case Western Reserve University, the Center focuses on the practical medical needs of individuals disabled by sensorimotor dysfunction, cognitive deficits, or limb loss. We create novel, cross-cutting assistive and restorative technologies within a structured framework that facilitates regulatory compliance, dissemination within the rehabilitation community and commercialization by outside manufacturers. APT Investigators have expertise in many technologies including implanted medical devices, microelectromechanical system design and neural engineering. Each technical skill is complemented by clinical professionals in each specialty. By creating an environment in which the developers of advanced technologies can interact freely with clinicians, rehabilitation professionals and consumers, we ensure that our continued work will result in new interventions that will enable veterans to maximize function, maintain health and be productive in their personal, professional and social lives.
In eukaryotes, protein glycosylation is an essential function of life. One of the most common forms of protein glycosylation is mucin-type O-glycosylation. It begins with the attachment of O-linked N-acetylgalactosamine (GalNac) to serine and threonine residues, which is facilitated by GalNac-transferases (GalNac-T's). Twenty different GalNac-T genes have been identified in humans thus far. Although GalNac-T's play similar roles in facilitating the primary glycosidic linkage to proteins, their encoding genes are not fully redundant, showing their potential variety in regulating protein glycosylation. Human homologs and species-specific GalNac-T's, have been identified in a variety of animal species, showing their high conservation throughout evolution. In this study, we investigated whether or not the “tail” regions of GalNac-T's are both necessary and sufficient to direct themselves to the Golgi.
### Advanced Research Computing

This core offers a variety of services including local high performance computing; local peta-scale online, nearline, and offline research data storage; ultra-high bandwidth networking; data visualization; and research database design and programming. It also provides consultation, collaboration, and support in all of these areas to assist in writing funding proposals, preparing proposal budgets and working with investigators on funded and unfunded research.
We perform a broad forensic analysis of the notorious Jeff the Killer photomanipulation, with the intent of resolving additional detail from the image and evaluating the truth or falsity of claims that the image features either high-school student Katy Robinson or Internet personality Laina Wilson beneath its alterations. Techniques used include lighting and shadow analysis, multiple-compression detection, JPEG ghost identification, contrast stretching, and unsharp masking. Based on the results of these tests, we conclude that while the Jeff the Killer model's facial features have been effectively destroyed by the image's manipulation, elements in the background survived the process relatively intact and indicate that the model is neither Wilson nor Robinson but some third party (most likely the individual who performed and published the manipulation).
Infection with nontuberculous mycobacteria (NTM) is a complication of lung disease in immunocompromised patients, including those with human immunodeficiency virus and acquired immune deficiency syndrome (HIV/AIDS), chronic obstructive pulmonary disease (COPD), and cystic fibrosis. The most widespread, disease-causing NTM is Mycobacterium avium complex (MAC), which colonizes the lungs as a combination of Mycobacterium avium, Mycobacterium intracellulare, and other mycobacterial species. While combination drug therapy exists for MAC colonization, there is no cure. Therapeutic development to treat MAC has been difficult because of its slow-growing nature, limiting the ability to characterize the bacteria’s growth. The development of a technology that allows observation of the bacterial strains that comprise MAC could provide a means to develop new therapeutics to treat this NTM. In these studies, we have developed a new methodology in which m. avium and m. intracellulare can be optimally grown to study each strain independently and combined as a potential means to study MAC growth kinetics and develop new therapeutics for this disease.
Case Transgenic and Targeting Facility Provides CRISPR/Cas9 Services

We offer a variety of services including development of transgenic mice, gene targeting by traditional homologous recombination in Embryonic Stem (ES) cells and CRISPR/Cas in fertilized eggs, chimera generation, ES cell line derivation, embryo cryopreservation, rederivation to specific-pathogen-free status, in vitro fertilization (IVF), intracytoplasmic sperm injection, reanimation of cryopreserved strains by embryo transfer and IVF, and surgeries including ovarian transplant, vasectomy and ovariectomy.

We recently introduced a service to make gene-targeted mice with CRISPR/Cas9 designer nucleases. CRISPR/Cas9 technology has revolutionized genetics, making the generation of mutant mice faster, cheaper and more reliable. The reagents are simple and inexpensive to design and construct, and the generation of mutant mice faster, cheaper and more reliable. We have used CRISPR/Cas9 successfully to generate both knockout and knockin mice in over 20 projects, and have about 20 other CRISPR/Cas9 projects at various stages of completion.

We are supported by user fees, the CWRU School of Medicine, the Case Comprehensive Cancer Center, the CWRU Clinical and Translational Science Collaborative and grants from the NIH and Cystic Fibrosis Foundation Therapeutics.
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<td>712</td>
<td>Kathryn Kwiatkowski</td>
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- **Department**: Leonard Gelfand STEM Center
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- **Author Affiliation**: Case Western Reserve University
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- **Key Words**: k-12 science, technology, engineering, math k-12 STEM

- **Abstract**: not applicable; Gelfand STEM Center will share information about K-12 programs for teachers and students
The evolution of CWRU entrepreneurship

The Case Western Reserve University LaunchNet (formerly known as the CWRU Blackstone LaunchPad) was established in 2012 with a mission to train the next generation of entrepreneurs on the CWRU campus.

With grants from the Burton D. Morgan Foundation, and the Blackstone Charitable Foundation, CWRU LaunchPad was conceived as a groundbreaking initiative giving university students and alumni the skills, knowledge, and guidance to start new companies.

In 2015, the Burton D. Morgan foundation established the Northeast Ohio LaunchNet (NEOLaunchNet), refining the focus of the entrepreneurship programs at CWRU, Baldwin Wallace University, Kent State University, and Lorain County Community College.

As a member of the Burton D. Morgan NEO LaunchNet community, CWRU LaunchNet pursues its mission to help students and alumni turn their ideas into products and services. Students and alumni who engage with CWRU LaunchNet are encouraged to explore entrepreneurship as complementary or alternative to traditional career paths.

CWRU LaunchNet serves all academic disciplines of Case Western Reserve University, the Cleveland Institute of Art, and the Cleveland Institute of Music.

Student and alumni entrepreneurial success

From 2012 to date, CWRU LaunchNet has assisted more than 500 members of its community to research and establish enterprises that have collectively won competitions and raised investments of more than $5 million.

Leveraging and consolidating resources both on the CWRU campus and through the wider regional, national, and international
Non-Prion Host Factors May Participate in Initiation of Prion Protein Aggregation

Neurodegenerative diseases such as, Parkinson’s, Huntington’s, Alzheimer’s disease, and prion disease are believed to share a common pathogenic mechanism involving the aggregation of a variety of cellular proteins in the brain. Prion diseases are associated with the formation of insoluble and protease-resistant prion protein (PrPSc) through the aggregation of a normal cellular form (PrPC). The events which lead to protein aggregation, however, are poorly understood. Clarification of the factors which initiate and propagate aggregation will greatly facilitate the development of much needed treatments for these devastating diseases. Using the recently-developed real-time quaking induced conversion (RT-QuIC) assay, we investigated the aggregation behavior of recombinant bank vole PrP (rBVPrP) in the absence or presence of brain homogenate from mice expressing no PrP (KO), wild-type mice (WT), or mouse prion (139A)-infected mice. BVPrP was chosen as it has been found to be a universal substrate for PrPC into PrPSc conversion in vivo and in vitro. RT-QuIC assay revealed that brain homogenate from WT or infected mice triggered aggregation of BVPrP with infected brain samples displaying earlier and stronger seeding activity than the WT. Surprisingly, brain homogenate from KO mice also exhibited seeding activity. The RT-QuIC products were examined by Western blot analysis, confirming the presence of protease-resistant PrP. Our results suggest that non-PrP host factors in the brain also participate in initiating PrP aggregation and may play a role in PrPSc formation. The authors are grateful to Drs. Romany Abskaron and Jiyan Ma from the Van Andel Research Institute for providing BVPrP. The study was supported by the National Institutes of Health NS087588 and NS096626 as well as the CJD Foundation.

Elevator Speech
Real-time quaking induced conversion (RT-QuIC) is versatile tool, helpful not only in the diagnosis of prion disease, but powerful in furthering understanding of prion biology. Insight into pathways of prion disease and related proteinopathies are critical to the development of therapeutics, which are currently lacking.

Key Words
- RT-QuIC
- ThT
- Neurodegeneration
- Prion

Abstract

Neurodegenerative diseases such as, Parkinson’s, Huntington’s, Alzheimer’s disease, and prion disease are believed to share a common pathogenic mechanism involving the aggregation of a variety of cellular proteins in the brain. Prion diseases are associated with the formation of insoluble and protease-resistant prion protein (PrPSc) through the aggregation of a normal cellular form (PrPC). The events which lead to protein aggregation, however, are poorly understood. Clarification of the factors which initiate and propagate aggregation will greatly facilitate the development of much needed treatments for these devastating diseases. Using the recently-developed real-time quaking induced conversion (RT-QuIC) assay, we investigated the aggregation behavior of recombinant bank vole PrP (rBVPrP) in the absence or presence of brain homogenate from mice expressing no PrP (KO), wild-type mice (WT), or mouse prion (139A)-infected mice. BVPrP was chosen as it has been found to be a universal substrate for PrPC into PrPSc conversion in vivo and in vitro. RT-QuIC assay revealed that brain homogenate from WT or infected mice triggered aggregation of BVPrP with infected brain samples displaying earlier and stronger seeding activity than the WT. Surprisingly, brain homogenate from KO mice also exhibited seeding activity. The RT-QuIC products were examined by Western blot analysis, confirming the presence of protease-resistant PrP. Our results suggest that non-PrP host factors in the brain also participate in initiating PrP aggregation and may play a role in PrPSc formation. The authors are grateful to Drs. Romany Abskaron and Jiyan Ma from the Van Andel Research Institute for providing BVPrP. The study was supported by the National Institutes of Health NS087588 and NS096626 as well as the CJD Foundation.
Oncostatin M (OSM) induces epithelial-mesenchymal transition (EMT) and cancer stem cell (CSC) properties in cancer cells. Paradoxically, OSM induces a growth-inhibiting senescence in normal human mammary epithelial cells (HMEC). Senescence is induced by stresses like aberrant oncogene signaling and serves as a major tumor-suppressive barrier to transformation and tumorigenesis. Previous reports show that aberrant reactivation of EMT-inducing transcription factors (EMT-TFs) promotes senescence bypass and drives tumor initiation in addition to providing cancer cells with mesenchymal and stem cell properties that drive tumor progression. Conversely, our studies indicate that OSM induces aberrant EMT and CSC-properties that may actually engage senescence in normal cells. Indefinite lifespan “Normal” HMEC were subjected to treatment with recombinant OSM, then growth assays assessed proliferation and qRT-PCR assessed expression of senescence-associated β-galactosidase (GLB1), an epithelial marker E-cadherin (CDH1), a mesenchymal marker Vimentin (VIM), the EMT-TF Snail (SNAI1), and the CSC markers CD44 and HAS2. Flow cytometry examined BrdU-incorporation and CD24/CD44 expression to assess proliferation and a CSC phenotype. In Normal HMEC, OSM reduced growth by 80% and induced GLB1, EMT (reduced CDH1; increased VIM and SNAI1), and CSC marker (CD44 and HAS2) expression. Notably, OSM induced a CD44+ population containing mostly non-proliferating (BrdU-) cells. Both Snail and CD44 were also induced during oncogenic RAS-induced senescence, and Snail expression alone reduced growth and induced CD44. Our results suggest that like aberrant oncogene signaling, aberrantly induced EMT and CSC-properties may engage senescence in normal cells rather than promote senescence bypass. Defining the mechanism linking senescence, EMT, and CSC-properties will lead to novel “pro-senescence” therapies that may inhibit metastasis and tumor recurrence and expand our repertoire of cancer therapies.
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<td>151</td>
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**Department**

**Phone**

**Title**

*Slitlamp-mounted Smartphone Adapters Using Reverse Engineering and 3D Printing*

**Author Status**

Case Western Reserve University

**In Graduate Student Competition**

True

**Author Affiliation**

Case Western Reserve University

**Category**

Applied Science

**Published?**

False

**Presentation Type**

Poster

**Elevator Speech**

Slit-lamp smartphone adapters have become widely available, however, only a limited number of phone models are supported. We describe a process using precise measurements and 3D printing to build customizable adapters that fit virtually any smartphone to any slit lamp.

**Key Words**

3D Printing, Smartphone, Ophthalmology

**Abstract**

3D printing provides key opportunities to design novel tools to promote medical education and research. One such avenue is through printing adapters which fit onto phones to that can be attached to the slit-lamps that are used by physicians during eye checkups. These adapters allow real-time video recording and photography. Slit-lamp smartphone adapters have become widely available, however, only a limited number of phone models are supported. We describe a process using precise measurements and verification to obtain dimensions of smartphones ranging from Apple iPhone 5, 6, and 7 models to Samsung models. Output stereolithography (STL) files were then created using Fusion 360 CAD software (AutoDesk, San Rafeal, CA) as well as Simplify3D (Simplify3D, LLC, Blue Ash, OH) to design custom adapters. Each customized model was tested on our clinics’ slit lamps and verified for fit and ease of obtaining photographic images of the fundus and anterior segment.
UP__AD__ Vocabulary: Prepare for the GRE offers an interactive, patent-pending, multi-sensory vocabulary acquisition and retention method. As individuals "play" a virtual piano on an iPad, they are introduced to 440 most encountered vocabulary words on the GRE. Aural, visual and kinesthetic elements are presented that reinforce word meanings and aid retention. After playing two octaves, they are challenged with Practice, Rehearsal, Performance and Master Class exercises. When they have played all 88 keys, they can take a practice test; the questions are formatted to replicate current graduate-level exams. Additionally, individuals can continue upgrading their vocabulary by engaging the Major and Minor Keys sections and interacting with increasingly more difficult vocabulary. Through Practice, Rehearsal, Performance and Master Class activities, they prepare themselves for "pop" quizzes and ultimately a final exam on all of the words.
The ratio of HLA-DR and VNN2+ on CD14+ Myeloid Derived Suppressor Cells Can Distinguish Glioblastoma from Radiation Necrosis Patients

Glioblastoma (GBM) is the most aggressive and lethal type of brain cancer with a median survival of less than two years even following aggressive treatment. Among the many challenges in treating patients with this devastating disease is the ability to differentiate Magnetic Resonance Imaging (MRI) images that appear following radiation therapy, often termed "radiation necrosis" from true GBM recurrence. Radiation necrosis (RN) and GBM are very difficult to distinguish and currently only a brain biopsy can conclusively differentiate these pathologies. In the present study, we introduce a differential diagnostic approach using a newly identified Myeloid-Derived Suppressor Cell (MDSC) biomarker, vascular non-inflammatory molecule 2 (VNN2+), in combination with expression of traditional HLA-DR on peripheral blood CD14+ monocytes isolated from GBM and/or RN patients. We performed proof-of-principle experiments confirming the sensitivity and specificity of this approach based upon the combined expression levels of HLA-DR and VNN2 among CD14+ Mo-MDSC, which we called the DR-Vanin Index or DVI. The DVI was able to distinguish GBM from RN patients with a high degree of certainty (n=18 and n=6 respectively; p=0.0004). This novel, quick and inexpensive blood-based liquid biopsy could potentially replace invasive brain biopsies in differentiating GBM from RN patients using a minimally-invasive technique.
**Title:** Models of Schistosomiasis transmission and control based on Stratified worm burden approach: target reduction and parasite elimination

**Abstract**

Schistosoma parasitic worms sustain a complex lifecycle between human and snail hosts via free-swimming intermediate larval stages. Multiple biological, demographic and environmental factors affect their transmission and control in host communities. Among them are parasite mating and reproduction within host, human-snail interactions, environmental drivers of snail population biology, human mobility et al. Some of them serve to enhance local transmission, other may suppress it, so their inclusion is important for accurate quantitative prediction of ongoing and planned schistosomiasis control programs. However, their inclusion raises many challenging mathematical and computational problems. To address these issues, we have developed a tractable stratified worm burden (SWB) approach and new parameter-fitting codes and procedures, that allow efficient simulation of infection transmission and control interventions. We applied our models/simulations for realistic datasets collected in SCORE and in other control programs. It allowed us to explore optimal control strategies for WHO target reduction (2020 and beyond), as well as the problem of elimination. Among other results we found efficient strategies for target reduction/elimination would require integrated control (human MDA treatment along with snail removal). Neither one by itself can achieve the goal.
Various strategies have been attempted to educate surgical novices, who are now expected to demonstrate competency in an increased skillset during decreased training time. This novel, video-based, self-directed curriculum can effectively teach basic surgical knot-tying and suturing skills to medical students.

**Abstract**

Various strategies have been attempted to educate surgical novices, who are now expected to demonstrate competency in an increased skillset during decreased training time. This project aims to educate medical students in basic surgical knot-tying and suturing skills through a novel, self-directed, video-based curriculum.

The ‘Self-Directed Surgical Skills’ (SDSS) elective is a four-month-long course offered to medical students. The curriculum consists of two modules (Knot-tying and Suturing) containing a total of twelve stepwise tutorial videos ranging from 10 to 20 minutes that each include a demonstration of the skill with best-practice tips, information about use of the skill in surgical practice, and advice on practicing the skill. Thematically similar videos are released to students every 2-4 weeks. Students watch and practice at their own pace, self-report hours practiced, and submit completed practice materials. Three open practice sessions are held over the course for students to periodically receive in-person guidance on their progress. Students are assessed on their knowledge of surgical skills and on their performance of 6 knot-tying and suturing tasks.

41 medical students are participating in the ongoing SDSS elective and preliminary results are presented here. Overall, students gave the videos a mean 4.37/5 Likert scale rating on their effectiveness for learning the skills taught. Students spent a mean 13.89 hours practicing skills taught in the videos and praised the video components for their clarity and concise yet thorough instruction. Students praised the in-person practice sessions for the helpfulness of individualized feedback. Students improved their knowledge of surgical skills over the course of the elective, scoring a mean 95% on the multiple-choice final exam, compared to a mean 56% on the pre-test.

Preliminary results suggest a video-based, self-directed curriculum can effectively teach basic surgical skills knowledge to medical students.
Distributed intelligence and robotics lab (DIRL) in the department of Mechanical and Aerospace Engineering will present physical robotic systems and tangible game technologies for live demonstrations to the public audience at the Research ShowCase. The presented robots will include: 1. Philos: a robotic friend for social interaction; 2. InchBots: swarm microrobotic platforms for implementing swarm intelligence; 3. OrigamiBots: novel robotic mechanisms based on origami; and 4. TAG-Games: tangible geometric games for cognitive assessment and training.
Duration of Jail Sanctions and Sentences in Specialized Courts Predicting Readiness to Change, Drug Use and Treatment Outcomes

We examined the effects of jail sanctions and sentences on drug use, treatment outcomes, and motivation to engage in treatment in specialized courts. The forthcoming results will have implications for the use of jail sanctions and sentences in these programs.

Specialized court dockets provide judicial supervision and linkages to community treatment services to eligible offenders in lieu of traditional probation. During the course of these programs, however, participants may accrue days in jail while awaiting entry into these court dockets, waiting for a community treatment slot, or receive jail sanctions due to noncompliant behavior (e.g., failed drug tests) or being arrested on new criminal charges. Few studies have examined the effects of jail sanctions and sentences on treatment outcomes in specialized court dockets. The current study, which is in progress, uses data from a drug court and veterans' court in Ohio to assess the effects of jail sanctions and sentences on participants' readiness to change (i.e., engage in treatment), drug use, and treatment completion. Jail days will be recorded between their initial arrest date, plea date/sentence date and six months after program intake and will be used to predict whether these days in jail affect participants' readiness to change, abstinence, and treatment outcomes. Predicted results are that longer durations in jail preceding specialized court entry and during the program will be associated with lower levels of readiness to change, failed drug tests, and unsuccessful substance use/mental health treatment episodes. The results will have implications for the use of jail sanctions and sentences prior to and during specialized court programs.
Find out how the Kelvin Smith Library (KSL) & the Freedman Center for Digital Scholarship resources and services can contribute value and depth to all types of research. Resources include interactive reference books, cutting edge market research reports for high-tech industries, data collections, and full text access to primary source materials as far back as the 17th century. The KSL Alumni Online Library, allows alumni to access some resources from any remote location. The Freedman Center for Digital Scholarship provides access to and basic training for statistical analysis, GIS, and multimedia software and equipment. A poster printing service is also available for presenting research at conferences and other events. Additionally, the Center’s Librarians are on hand to work with researchers who wish to incorporate digital tools and technology into their research through consultation, project management, and connection to services and resources on campus.
Individual pitch control is a new technique used in the field of wind turbine control. It reduces the asymmetric mechanical loads on multi-megawatt turbines, therefore reducing mechanical fatigue and extending the lifetime of the turbine. In this work, a collective and an individual pitch controller are developed for the National Renewable Energy Laboratory’s 5 MW reference wind turbine.

First, a baseline collective pitch controller is developed using the Quantitative Feedback Control Toolbox in Matlab. Then, an individual pitch controller is developed. The individual pitch controller is combined with the collective pitch controller in order to simulate the overall pitch control dynamics. Lastly, the performance of the combined individual and collective pitch control is compared to the collective pitch control alone. The addition of the individual pitch controller leads to reduced loads on the wind turbine without decreasing power generation.

My research focuses on individual pitch control for wind turbines, used to reduce the asymmetric mechanical loads on the blades. Individual pitch control works on top of the collective pitch control by making small adjustments to each blade. I design an individual pitch controller and compare its performance to the collective pitch control alone. The addition of the individual pitch controller leads to reduced loads on the wind turbine without decreasing power generation.
Abstract

Background and Purpose – It is unknown whether one method of neuromuscular stimulation for post-stroke upper limb rehabilitation is more effective than another. Our aim was to compare the effects of contralaterally controlled functional electrical stimulation (CCFES) to cyclic neuromuscular electrical stimulation (cNMES).

Methods – Stroke patients with chronic (> 6 months) moderate to severe upper extremity hemiparesis (n=80) were randomized to receive 10 sessions/week of CCFES- or cNMES-assisted hand opening exercise at home plus 20 sessions of functional task practice in the lab over 12 weeks. The task practice for the CCFES group was stimulation-assisted. The primary outcome was change in Box and Blocks Test (BBT) score at 6-months post-treatment. Upper extremity Fugl-Meyer (UEFM) and Arm Motor Abilities Test (AMAT) were also measured.

Results – At 6-months post-treatment, the CCFES group had greater improvement on the BBT, 4.6 (95% CI: 2.2, 7.0), than the cNMES group, 1.8 (95% CI: 0.6, 3.0); between-group difference, 2.8 (95% CI: 0.1, 5.5), p=0.045. No significant between-group difference was found for the UEFM (p=.888) or AMAT (p=.096). Participants who had the largest improvements on BBT were less than two years post-stroke with moderate (i.e., not severe) hand impairment at baseline. Among these, the 6-month post-treatment BBT gains of the CCFES group, 9.6 (95% CI: 5.6, 13.6), were greater than those of the cNMES group, 4.1 (95% CI: 1.7, 6.5); between-group difference, 5.5 (95% CI: 0.8, 10.2), p=0.023.

Conclusions – CCFES improved hand dexterity more than cNMES in chronic stroke survivors.

Key Words

stroke rehabilitation      electrical stimulation
medical device            therapy
hand
Decreased Malaria Transmission in Kenya Led to Delayed Acquisition of Anti-Malarial Antibodies in Children and Adults

Malaria transmission is declining worldwide due to interventions such as insecticidal treated bed nets and indoor residual spraying. In our study population in western Kenya, we have observed a decline in the prevalence of asymptomatic Plasmodium falciparum (Pf) infection in children from 81% in 2003 to 14% in 2013. It has long been known that antibodies play an important role in the development of immunity to malaria. We sought to analyze changes in acquisition of anti-malarial antibodies over a 10-year period of declining transmission. Bioplex was used to measure immunoglobulin (Ig) G antibodies specific for 34 malarial proteins in healthy Kenyan children and adults from two cross-sectional cohorts (n=82 children, n=95 adults in 2003, and n=97 children, n=50 adults in 2013). The antibody magnitudes, prevalence, and seroconversion rates were directly compared between the two cohorts (2003 and 2013). Compared to the 2013 cohort, children and adults in 2003 had higher antibody magnitudes and prevalence, and faster seroconversion rates for the majority of the antibodies measured. For example, in 2003 the age groups 1-3, 4-6, 7-10, and 18+ years had prevalence values for merozoite surface protein (MSP) 6 of 50.0%, 58.3%, 83.3%, and 88.4%; in 2013 prevalence values for the same age groups were 17.2%, 27.0%, 32.3%, and 68.0%, respectively. Antibody magnitudes and prevalence in both cohorts tended to increase with age, as expected. An exception to this pattern was seen in antibodies to 4 out of 5 domains of Pf Erythrocyte Membrane Protein 1 (PfEMP1), in which children in 2003 and had higher antibody magnitudes than adults in 2003, while in 2013 antibody magnitudes increased with age. In summary, decreasing Pf transmission is associated with a decline in several anti-Pf antibodies across age groups. Lower transmission rates may lead to a slower acquisition of anti-malarial immunity and longer duration of susceptibility to symptomatic Pf infections.
Abstract

Problem: End Stage Renal Disease (ESRD) affects approximately 661,000 Americans. Among people living with ESRD, fatigue diminishes quality of life and is related to increased cardiovascular events and decreased survival. The incidence of fatigue in individuals with ESRD ranges from 60%-97%. Further, the prevalence of ESRD is greater among minorities than their Caucasian counterparts. African Americans constitute 37% of those receiving dialysis while only representing 13% of general population. However, it is unclear whether the prevalence and consequences of fatigue among individuals with ESRD vary by race.

Purpose: Our aim was to systematically review the literature on fatigue among those living with ESRD while examining the role of race on these outcomes.

Search Strategy: We conducted a literature search of PubMed/Medline and Web of Science. Reference lists from December 2005 to October 2016 were referred. The eligibility criteria included studies enrolling adults with ESRD undergoing dialysis treatment, utilized a quantitative metric to evaluate fatigue, and was an English-language publication.

Results of the Literature: Thirty-five studies meeting eligibility criteria were reviewed.

Synthesis of Evidence: The majority of research articles concluded that fatigue is an austere issue that needs to be addressed in order to improve quality of life and health outcomes. The disproportionate burden of ESRD on non-Hispanic minorities needs to be addressed. Two studies addressed fatigue by race, one reporting no variation in the prevalence of fatigue by race and the other found African Americans experienced less fatigue.

Implications for Practice: More research involving interventions to mitigate fatigue and to decrease the burden of this chronic condition in minority populations is needed. Future analysis will include a meta-analysis evaluating fatigue as it relates to race and gender. This will enable interventions to be tailored by race.
Epidemiological data and clinical observations suggest that erythropoietin (EPO) producing cells may exist in End-Stage Renal Disease (ESRD) kidneys. A small subset of ESRD patients have naturally occurring normal hemoglobin levels, without the use of blood transfusions or erythropoietin stimulating agents (ESA), but limited data exists in this field. We aimed to evaluate the prevalence and predictors of naturally occurring hemoglobin concentration > 12 mg/dl in hemodialysis patients.

Methods
We conducted a retrospective chart review of ESRD patients receiving hemodialysis at Centers for Dialysis Care in East Cleveland, OH, from April-September 2013. Data collected included demographics, the cause of renal disease, co-morbidities, duration of ESRD, dialysis access, indices of dialysis adequacy, systolic blood pressure, hemoglobin level, and other lab values. Multivariable regression models were utilized to identify factors associated with naturally occurring hemoglobin concentration > 12 mg/dl.

Results
In this cohort of 449 community dialysis patients, the prevalence of naturally occurring hemoglobin level > 12 mg/dL was 5.3%, slightly higher than previous reports of around 2%. In unadjusted analyses, compared to ESRD patients with a hemoglobin level > 10 mg/dL maintained with the use of ESA, the patients with naturally occurring hemoglobin > 12 mg/dL were more likely to be younger, male, with an arteriovenous fistula, longer dialysis vintage, lower systolic blood pressure and higher serum albumin level. In adjusted analyses, male sex, serum albumin, and systolic blood pressure remained statistically significantly associated with naturally occurring hemoglobin concentration > 12 mg/dL [OR 3.66 (95% CI 1.11-12.06); 14.10 (2.21– 90.11); and 0.98 (0.96 – 0.99), respectively].

Conclusion
In this sample of community dialysis patients, male sex, serum albumin, and systolic blood pressure were the strongest predictors of naturally occurring higher hemoglobin concentration.
Depressed force generation by the heart is a hallmark of human heart failure condition. Current therapies enhance force generation but elicit adverse side effects. Using a novel pharmacological molecule termed "Omecamtiv mecarbil" we show that force can be enhanced while potentially eliminating the side effects of current heart failure therapies.

**Abstract**

Depressed force generation is a hallmark of myocardium in human heart failure patients. Current ionotropic therapies enhance force generation but are commonly accompanied by undesirable side effects like tachycardia and ventricular arrhythmias by activating pathways such as cAMP signaling and by increasing the amount of cytoplasmic Ca2+ concentrations within the cardiac myocytes. In this study we used a pharmacological compound omecamtiv mecarbil (OM) that has the ability to bypass complex signaling pathways and instead directly target the myosin motor within the cardiac myocytes to enhance force generation. Indices of contractile function such as isometric force, myofilament Ca2+-sensitivity (pCa50), rates of crossbridge (XB) detachment (krel), recruitment (kdf), and magnitude of XB recruitment (Pdf) were measured both before and after OM incubation in chemically-skinned myocardial preparations isolated from human heart failure patients. Myocardial preparations from human donor hearts were used as controls. Our results show that OM incubation significantly enhanced the sub-maximal force production i.e., at forces lower than 50% of maximal force. Furthermore, OM-induced force increase was higher in the failing myocardium (~85% increase in failing vs. ~27% in donor myocardium). Additionally, the OM-induced slowing of krel and kdf, and enhancement in Pdf were also more pronounced in the failing myocardium. Our new findings suggest that OM is highly effective in increasing force generation in human heart failure patients due to its ability to prolong the time spent by XBs in their force-bearing state and by enhancing cooperative XB transition into their force-bearing state.
**Title**
Rechargeable Redox Flow Batteries: Limiting Current Density with Electrolyte Flow Reactant Penetration Flow Structure

**Abstract**
Rechargeable redox flow batteries with flow field designs have been demonstrated to deliver higher current density and power density in medium and large-scale stationary energy storage applications. Nevertheless, the fundamental mechanisms involved with improved electrochemical performance (e.g. higher limiting current density) in flow batteries with flow field designs have not been understood. In this poster, we propose a concept of “maximum current density” associated with 100% utilization of electrolyte reactant flow penetration into a porous electrode from a flow channel that can be achieved in any aqueous flow battery system with a “zero-gap” serpentine flow field architecture design. Three-dimensional fluid dynamic modeling is used to estimate the amount of fluid flow into a porous electrode in a prototype flow-field design, and consequently the amount of reactant within the electrode available for reaction. Validations of model calculations with experimental results are made using literature data from a vanadium flow battery with a serpentine flow structure over multiple layers of carbon paper electrode.
**Title:** Bioinspired Stimuli-responsive Materials: Concurrent Shape and Color Change in Programmed Cholesteric Liquid Crystal Elastomers

**Abstract**

Biological systems employ anisotropy to enable selectivity in motion, transport, or add functionality, like structural color. Resembling the structure-function relationships found in nature, cholesteric liquid crystals (CLCs) are inherently and selectively reflective, and shown to exhibit stimuli-induced changes in coloration particularly in compositions prepared with low-molar mass liquid crystals. Here, we report on the ability to pattern and imprint both color and shape (topography) change in monolithic elements prepared from cholesteric liquid crystalline elastomers. The materials examined here are of the main-chain subclass, synthesized via photopolymerization of an acrylate formulation. The spatial anisotropy was initiated via photoalignment of dye molecules on substrate surfaces. Within the presentation, we will elucidate subtle nuances in the fundamental nature of the mechanics that differentiate the stimuli-response of these materials from nematic liquid crystalline elastomers. The ability to simultaneously and concurrently regulate the color as well as the direction of reflected light could open up interesting applications in textiles, optics, and sensing.
Bisphosphonate Effects on Gingival Crevicular Fluid at Baseline and After Periodontal Treatment

To compare the differences in cytokines and bone turnover markers within the gingival crevicular fluid (GCF) of women receiving bisphosphonate therapy (BP) at baseline and after scaling root-planing (SCRP). 60 postmenopausal women (PMW) with periodontitis participated. 30 used BP and 30 did not; within each group, 15 participants received SCRP and 15 did not. GCF samples were taken at baseline and 6 weeks after SCRP using a paper point in the gingiva and stored in -80C. IL1-B, TNFa and RANKL concentrations were measured by enzyme-linked immunosorbent assay (ELISA). Concentrations were compared between BP and control groups (CG) at baseline and reevaluation. Significance level was set to p<0.05. Significant baseline difference in GCF IL1-B is identified between participants who used BP vs. no BP used. (167±46.7vs.191±50.0;p=0.015), but not TNFa or RANKL. The BP group had significant difference between baseline and reevaluation in IL1-B (191±50.0vs.159±41.9;p=0.009) and TNFa (11.0±3.83vs.6.40±3.86;p<0.001) but not RANKL. In CG, no significant differences at baseline, but significant difference between baseline and reevaluation in all parameters respectively (167±46.7vs.137±50.0;p=0.017;7.92±3.36vs.5.57±2.78;p=0.004;161±36.9vs.124±31.8;p<0.001). There are no significant baseline differences between PMW who received SCRP vs. no SCRP. There was a significant difference between baseline and reevaluation in PMW who received SCRP versus no SCRP in all parameters respectively (176±42.5vs.124±32.8;p<0.001;9.06±3.18vs.2.78±1.63;p<0.001;172±26.9vs.125±34.4 p<0.001). PMW who received BP and SCRP compared to those having SCRP alone had significantly different changes at reevaluation in all parameters respectively (19.4±5.6vs.39.4±2.12;p<0.005;10.94±2.7vs.8.46±1.01;p<0.001;19.8±9.9vs.42.0±5.1;p<0.001). BP have an effect on GCF markers at baseline and on SCRP outcomes. SCRP effects GCF in all PMW. In conclusion, BP modulate host-response in periodontal treatment.
Abstract

Background:
Chronic diseases are major public health concerns, disproportionately affecting the health and well-being of low-income populations. A multi-component farmers’ market (FM) approach is identified as a promising environmental intervention strategy for promoting healthy diet and thereby preventing chronic diseases among low-income populations. A primary goal of this study is to examine significant factors associated with FM use among SNAP recipients living within one mile of a FM in an urban context.

Methods:
This study used the data drawn from the FreshLink study, a five-year mixed methods study of the public health benefits of FM among people receiving SNAP. A cross-sectional survey was conducted between June and August, 2015 with a sample of adult SNAP recipients with children. A multinomial regression model (N = 270) was used to examine factors associated with FM use behaviors among SNAP recipients. Participants were divided into four groups (i.e., Never, Not in Last Year, 1 or 2 Times, and 3 or More Times) based on the number of FM visits during the past year. The reference category was the 3 or More Times group.

Results:
The results of the multinomial regression model indicate that the odds of awareness of FM near their home (OR = 0.25, p<.01) and healthy food incentive program (OR = 0.41, p<.05), perception of quality of fruits and vegetables at FM (OR = 0.65, p<.05), and fruit and vegetable preparation self-efficacy (OR = 0.49, p<.05) were significantly lower among those who never visited FM compared to the reference group. Similarly, the odds of awareness of FM near their home (OR = 0.46, p<.05) and social connectedness to FM (OR = 0.45, p<.05) were significantly lower among those who had visited FM before but not in the last year compared to the reference group.

Conclusions:
The findings of this study inform levers to target intervention strategies as well as policy and practice decisions to improve healthy diet among low-income populations.
**Title**
Evaluating Neuroendocrine Differentiation and Its Clinical Significance in Radical Prostatectomy Specimen

**Author Status**
In Graduate Student Competition

**Author Affiliation**
Case Western Reserve University

**Published?**
True

**Elevator Speech**
Neuroendocrine differentiate in prostate cancer may help predict responsiveness to hormone treatment

**Key Words**
Prostate Cancer, Neuroendocrine, Hormone Therapy

**Abstract**

Introduction and Objective: Neuroendocrine differentiation (NED) has been recognized in prostatic adenocarcinomas. It has been shown to increase in high-grade and high-stage prostate cancers and particularly in hormone-refractory tumors. However, the prognostic value of NED in prostate adenocarcinoma is not well understood due to conflicting results in reported studies. Genomic studies have suggested that there is intra-tumor heterogeneity of neuroendocrine differentiation in prostatic adenocarcinoma.

Design: Thirty-six radical prostatectomy cases with a diagnosis of prostatic adenocarcinoma were chosen from our archival specimens, including 18 patients who developed recurrent cancer after curative surgery with PSA level >0.1 ng/mL, and 18 patients whose cancers did not recur during matched follow up times. NED was subjectively evaluated by performing immunohistochemistry (IHC) for Chromogranin A (CgA), the scores were evaluated by two pathologists. Ten areas were randomly selected from areas of cancer on each whole mount section, and the CgA IHC staining intensity in these areas was graded as 0-5.

Results: CgA staining intensity is positively associated with PSA serum level. Significant intra-tumoral heterogeneity of CgA staining intensity was observed. The cumulative CgA scores from 10 areas were higher in specimens from patients whose cancers relapsed, as compared with specimens from patients whose cancers did not recur. Mean cumulative CgA score is 18.72 ± 2.78 in the relapsed group and 8.28 ± 1.44 in the remission group.

Conclusion: This study reveals that intra-tumor heterogeneity of NED exists in prostate adenocarcinoma, which may limit clinical evaluation. Though the data is not conclusive, we do observe a lower level of NED in patients in remission compared to patients with a clinical failure in treatment by thorough evaluation of NED in prostate sections. This study potentially provides guidance to clinical usage of NED in prostate adenocarcinoma.
Antibiotic resistance and the decline in the development of new antibiotics are an imminent and urgent global threat to modern healthcare. Antivirulence agents are small-molecule compounds that inhibit the production of disease-causing toxins and virulence factors without killing the bacteria. By disarming the pathogen, these compounds aid the host immune system in clearing the infection. Lack of survival pressure suppresses the emergence of resistance. Antivirulence agent F19 is a broad-spectrum biaryl hydroxyketone small molecule that inhibits toxin formation in gram-positive pathogens by blocking transcription factor AgrA from binding to its cognate promoter DNA. In vivo, F19 treatment rescues mice injected with a lethal dose of methicillin-resistant Staphylococcus aureus (MRSA) from death by sepsis. In a MRSA murine wound infection model, topical treatment of F19 increases wound healing significantly without reducing the bacterial load on the wounds. In vitro, F19 inhibits cell lysis of erythrocytes, monocytes and macrophages caused by MRSA, Staphylococcus epidermidis, Streptococcus pyogenes, Streptococcus pneumoniae, and Bacillus cereus. F19 treatment of Clostridium difficile reduces the levels of disease-causing toxins A and B hundred-fold. In Bacillus anthracis, the causative agent of anthrax, F19 treatment reduces the minimum inhibitory concentration (MIC) of the aztreonam antibiotic from 256 to less than 0.1 ug/ml. This data provides extensive support for antivirulence therapy as a viable alternative or perhaps an adjuvant to conventional antibiotic treatment.
Assertive Community Treatment (ACT) is an evidence-based practice for individuals with severe mental illness (SMI) and co-occurring disorders. Through its community-based, interdisciplinary team approach, ACT provides time-unlimited services that include case management, psychotherapy, medication management, employment services, substance abuse treatment, and supportive housing. When implemented with full fidelity, ACT has been shown to reduce inpatient hospitalizations, increase retention in treatment, and improve outcomes related to housing stability, employment, and substance use. At its conception, ACT was presumed to be a “treatment for life.” However, with the mental health field’s recent shift to recovery-oriented practices, current literature suggests that individuals with SMI and co-occurring disorders may successfully transition out of ACT to less intensive services. This shift necessitates a clinical measure that can assist ACT teams in identifying individuals who may be ready to transition.

This conceptual study first identifies the critical factors necessary to determine transition-readiness by analyzing studies testing ACT outcomes to boil down the outcomes most likely to change with an ACT intervention. Next, by assessing the efficacy and effectiveness of three scales recently developed to assess transition-readiness, the study determines strengths and weaknesses of existing methods. Finally, the study proposes a more comprehensive transition-readiness scale that could be adopted by ACT teams for intake, treatment planning, and transition-readiness purposes. The study also produces a prototype transition-readiness guide for use by ACT teams considering implementing transition-readiness processes. Future research should focus on assessing the validity and reliability of the new measure.
To identify the social determinants of health (SDH) factors associated with the prevalence of severe periodontal disease in postmenopausal women (PMW) and to compare periodontal parameters with demographic, lifestyle factors, anthropometric measurements and pre-existing diseases in the northeast region of Ohio. Retrospective, cross-sectional study was conducted using the Case Cleveland Clinic Postmenopausal Wellness Consortium (CCCPWC), a database of over 900 PMW. Subjects were divided into two groups based on the prevalence of periodontal disease (PD): healthy, n=214; and severe, n=113. Periodontal parameters including: median number of teeth loss (MNTL), median probing depth (MPD), median recession (MR), and bleeding on probing (BOP) were recorded. Additionally, anthropometric measurements: body mass index (BMI) and fracture risk assessment tool (FRAX) score, lifestyle factors: smoking, average alcohol consumption (AAC), multivitamin supplement use (MSU), socio-economic status: ethnicity/race, household income, and education level, and pre-existing diseases: secondary osteoporosis, and diabetes were collected. Data were analyzed using the Pearson’s chi-square, Fisher’s exact test and non-parametric tests: Spearman’s rho, Kruskal-Wallis, and Mann-Whitney U (? = 0.05). MNTL, and BMI in PMW with healthy and severe PD were (5, 0-32 vs. 8, 0-32; p=0.016), and (25.9, 13.0-51.0 vs. 24.6, 14.0-57.0; p=0.003), respectively. BOP, MSU, and lower household income were significantly associated with healthy and severe PD (37.3% vs 96.3%; p<0.001), (27.8% vs 40.7%; p=0.046), and (43.5% vs 28.6%; p=0.001), respectively. FRAX score was significantly correlated with MNTL (r=0.427; p<0.001). MNTL, BMI, BOP, MSU, and lower household income were significantly associated with periodontal disease. ACC and ethnicity/race do not appear to significantly contribute to periodontitis. The results underscore a need to raise public awareness of the importance of periodontal health in PMW.
**Title**: Raman spectral markers of collagen denaturation and hydration are affected by radiation sterilization and high cycle fatigue damage

**Abstract**

Background: Raman spectroscopy is a powerful tool to non-destructively analyze bone chemical composition. Little is known regarding changes in Raman parameters secondary to gamma radiation and cyclic fatigue stress. In addition, Raman parameters have not been used to predict fracture risk.

Questions/Purposes: 1) Can Raman spectroscopic biomarkers of collagen denaturation and hydration be used to detect spectral changes following (a) 25kGy irradiation, (b) cyclic fatigue stress; 2) can Raman parameters be used to predict cycles to failure.

Methods: Unirradiated and gamma-radiation sterilized human cortical bone specimens that had been previously tested in vitro under high-cycle fatigue conditions were used. Spectral profiles were obtain at non-fatigue and fatigue damaged sites. Mineral, collagen, and water-related Raman intensity ratios were assessed. Multiple linear regression was used to model cycles to failure.

Results: Collagen-bound water was increased secondary to 25kGy gamma-irradiation (3220/2949: 0.104±0.023 vs 0.113±0.021, p=0.0007). Several new intensity ratios decreased secondary to 25kGy irradiation: 1640/959 (0.0290 ± 0.0032 vs 0.0281 ± 0.0030, p=0.0120), 1270/959 (0.0581 ± 0.0075 vs 0.0555 ± 0.0065, p=0.0022). Collagen denaturation increased in response to cyclic fatigue damage in nearly all subgroups. Collagen-bound water was positively correlated with collagen-denaturation (R²=0.264, p<0.0001). Fatigue stress, 1270/959, 3584/2949, 1070/959, and 3325/2949 were significant predictors of cycles to failure (R²=0.788, p<0.0001).

Conclusions: Collagen-bound water increases secondary to 25kGy irradiation and cyclic fatigue stress. A Raman marker of collagen denaturation increases secondary to cyclic fatigue stress and is positively correlated with collagen-bound water. Fatigue stress and Raman markers of ordered collagen amount, mineral-bound water, mineral maturity, and collagen bound water can be used to predict cycles to failure.
Genome stability is crucial for proper brain development and growth; in fact, loss of function of DNA repair genes such as Ligase 4 (LIG4) leads to microcephaly with intellectual disability and increased cancer risk. However, pathogenesis of DNA repair deficiency-related microcephaly is poorly understood. We hypothesized that mutations in LIG4 could cause microcephaly through three potential non-exclusive mechanisms: (1) reduced generation/proliferation of Neuronal progenitors (NPCs), (2) premature/abnormal differentiation of NPCs into neurons, or (3) increased apoptosis in one or both populations.

To test our hypotheses, we generated induced Pluripotent Stem Cells (iPSCs) from healthy controls and from one patient with a LIG4 mutation. In order to study proliferation, differentiation and apoptosis, we differentiated these iPSCs into NPCs, cortical neurons, and 3D cerebral organoids.

We found that defects in LIG4-deficient human models first arise during early stages of brain development. Specifically, we found that NPCs derived from LIG4-iPSCs display increased apoptosis. In addition, when converted into neurons, LIG4-iPSCs differentiated more rapidly than controls. However, after neuronal induction, LIG4 neurons displayed increased cell death. Finally, LIG4 cerebral organoids were at least 2 times smaller than control organoids. There was an increase in cleaved Caspase3 in the outer edge of the sub-ventricular-like zone of LIG4 organoids, further supporting a role for apoptosis in microcephaly. We used CRISPR/Cas9 technique to generate isogenic cell lines to rule out effects due to the genomic background. When irradiated, the CRISPR/Cas9 corrected LIG4 cell lines were no longer hypersensitive to gamma rays. In summary, we were able to recapitulate human microcephaly caused by mutations in LIG4 in vitro. Our models suggest that premature differentiation of NPCs followed by apoptosis of specific neuronal populations might play a significant role in microcephaly.
Androgen deprivation therapy (ADT) is the established treatment protocol for advanced-stage prostate cancer and initially induces tumor reversion. However, castration-resistant prostate cancer (CRPC) arises in a majority of ADT-treated patients, through unknown mechanisms. The cancer stem cell (CSC) model propose that tumors contain a reservoir of self-renewing cells resistant to conventional therapies such as ADT, and their increase in a treated tumor may be a reason for CRPC proliferation. CD133 (also known as Prominin-1) is a membrane-bound pentaspan glycoprotein that is frequently expressed by CSCs, and has been used as a biomarker for isolation and characterization of these cells. In this study, we investigated the immunohistochemical (IHC) expression of CD133 in the prostate cancers of patients who were and were not treated with ADT. Surgical pathology specimens (formalin-fixed, paraffin-embedded blocks) from 28 advanced-stage prostate cancer patients treated with ADT were retrieved from Department of Pathology archives of University Hospitals Cleveland Medical Center and were compared with 10 prostate cancer specimens from patients who had not received ADT. IHC staining for CD133 antigen using rabbit polyclonal anti-CD133 antibody was performed on the histologic specimens. The IHC expression of CD133 in each specimen was evaluated and the intensity of staining was labeled a numerical value on a scale from 0 to 5, whereas 0 represents no staining and 5 represents strong staining. The intensity of CD133 staining in the malignant cells in ADT-treated patient specimens was higher in intensity compared to specimens from patients who had not received ADT. The mean intensity score in ADT-treated specimens was 2.4 ± 0.72, in contrast to a mean intensity score of 1.5 ± 0.93 in non-ADT treated specimens. This result supports the hypothesis of CSC expansion in CRPCs. The correlation between CD133 expression and clinical tumor progression deserves further investigation.
Saturn’s moon Titan has lakes of Liquefied Natural Gas (LNG), and NASA is in the process of designing a submarine to explore these seas. First, however, the properties of these seas need to be estimated, and we have built a model to provide those estimates.

Abstract

Saturn’s moon Titan has a remarkably dense nitrogen atmosphere and supports the only known stable, accessible liquid seas other than planet Earth. These lakes are primarily composed of liquid methane and liquid ethane, with significant amounts of dissolved nitrogen gas. NASA is currently designing a submarine to explore the seas from surface to coastline to seabed, and the first step in the design process is to predict how the liquid properties change with depth. The density range, in particular, is crucial to sizing the ballast system of the submarine, and has to be determined for both methane-rich and ethane-rich seas. This presentation discusses two distinct thermodynamic models for obtaining properties of the Titan seas based on measured surface properties from Cassini. First, an equi-chemical potential model is used, which assumes that the chemical potential at each layer remains the same while other thermodynamic properties vary. The second method assumes two bounds on the solubility changes with depth, 1) a surface solubility (SS) model which assumes that solubility does not vary with depth and 2) a full solubility (FS) model which assumes that solubility varies with each depth layer.

In general, the variation between seas of different composition is much greater than the variation between depth layers. At low depths, properties are expected to be approximately constant, though a methane-rich sea may be unstable. The density range the submarine must manage is about 20%, much higher than in any body of water on Earth.
Enhancer of zeste homolog 2 (EZH2), a histone methyltransferase, is the catalytic subunit of the polycomb repressive complex (PRC2) involved in chromatin remodeling and gene silencing through methylation of histone H3 on lysine 27 (H3K27). Based on the aberrant expression of EZH2 it is considered to be a bona fide oncogene and has emerged as an important therapeutic target in prostate cancer. Therefore, blocking EZH2 catalytic activity can be a preventive and/or therapeutic approach for the treatment of EZH2 overexpressing cancers. Our multistep approach of molecular modeling and direct binding has led to the identification of plant flavone luteolin (3',4',5,7-tetrahydroxyflavone) as a specific inhibitor of EZH2 with preferential blocking of its catalytic site. We tested the ability of luteolin in targeting EZH2 utilizing human prostate cancer cells. Treatment of DU145 and 22Rv1 cells, which possess high constitutive EZH2 expression, with 5-20µM luteolin significantly inhibits EZH2 and SUZ12 protein expression and reduced H3K27me3 and H3K27me2 protein and its enzymatic activity in dose and time dependent manner. In further experiments, knockdown EZH2 in cancer cells significantly reduced H3K27me3 and H3K27me2 activity and diminished migration, proliferation and invasion. Luteolin was also effective in suppressing in vitro methylation performed using recombinant PCR2 complex and recombinant histone 3 protein. These events led to increase in the expression of E-cadherin, SLIT2 and TIMP3 which are potential tumor suppressor genes controlling invasiveness. Interestingly, treatment of cells with proteasome inhibitor, MG132 together with luteolin did not prevent EZH2 degradation indicating that proteasomal degradation might not contribute to EZH2 inhibition. Taken together, our study suggest that luteolin acts on the catalytic binding site of EZH2 and inhibit the H3K27 trimethylation and induce the expression of EZH2 targeted tumor suppressor genes.
One in four people in Cuyahoga county live in areas that lack access to healthy food options. Health Improvement Partnership-Cuyahoga (HIP-C) is a countywide consortium of more than 100 local organizations. One of the goals of HIP-C is to align partnerships and resources to establish a local model for healthy food retail in Cuyahoga County.

To increase access to healthy food in neighborhoods considered food deserts, HIP-Cuyahoga launched a healthy food retail [HFR] initiative in 2015. Based on a successful model from The Food Trust, HIP-Cuyahoga supports corner store-owners to increase the amount and variety of fruits, vegetables, low fat dairy, whole-grains and lean proteins; ensure that healthy food options are affordable and high quality; increase the consumption of fruits, vegetables and healthier options among residents; and educate the community to the benefits of eating fresh fruits and vegetables. In its first year, HFR was implemented in and around 22 census tracts in priority neighborhoods of Cleveland and East Cleveland. A total of ninety-one stores were identified corresponding to the targeted census tracts (or .5 miles buffer). Upon screening, fifty-seven stores were short-listed and reviewed by community residents. To date 22 stores signed a Memorandum of Understanding (MOU). The store is then supported to move through a series of three phases: Phase 1-introduce 4 new healthy items; Phase 2- introduce 2 new healthy items and Phase 3-healthy food identification campaign.

Through collaborative efforts, HFR is paving the way to increase access to nutritious foods while working with the community to determine areas of highest need and what consumers are most likely to purchase. Community partnerships with healthcare providers, local food distributors and nutrition educators have the ability to strengthen such projects by bringing together local organizations to see the project through from planning to implementation.
SCSAM is one of Case Western Reserve University's largest core facilities, providing a variety of instrumentation for the microstructural and compositional characterization of materials as well as surface and near-surface chemical analysis. The Center's equipment is complemented by a staff of professionals that are available to assist and train academic, research and commercial users. Fully trained users are permitted independent access to the lab, while users with particularly difficult samples or those that are unsure how to obtain the most useful data can utilize the services of a staff expert. Some of the routine services offered include guidance with sample preparation, technical assistance to obtain data, and data analysis. Each year more than 250 individual researchers from the academic, non-profit, and commercial sectors utilize the Center. From creating a space for equipment that would otherwise not be available to startup companies to training major industrial users how to efficiently extract useful information, SCSAM supports regional economic growth.
Methylguanidine (MG), a guanidino compound, is a small water-soluble solute that accumulates in uremic patients and implicated in uremic toxicity. We studied the behavior of MG in end-stage renal disease patients on chronic dialysis compared to normal controls.

**Method**
Observational study included six normal controls and seven chronic dialysis patients. Blood and 24-hour urine samples collected from control group; while blood and dialysate samples collected from dialysis group (start, mid, and end of dialysis sessions). Urea, creatinine (Cr), and MG were measured by LC-MS/MS method. Mean levels, clearance, and production/excretion rates were calculated assuming first order kinetics, and statistical methods (Student’s t test, Pearson correlation coefficient) were used for data analysis. Results are expressed as mean ± standard deviation (SD).

**Results**
The mean predialysis plasma MG level in chronic dialysis subjects was more than 100 fold than in the control group (5.17 ± 0.99 vs. 0.047 ± 0.01 µM, respectively; P = 0.0005). In comparison, the mean predialysis urea level was only three-fold the normal level (94.4 ± 49.4 vs. 31.9 ± 6.9 mg/dL, respectively; P = 0.02). The mean production rates of MG were 47.12 (± 13.6) and 4.21 (± 3.4) µmol/day in chronic dialysis patients and healthy individuals, respectively (P < 0.05). The effective clearance rates for urea and Cr in dialysis patients were 238.83 (± 69.4) and 173 (± 51.1) ml/min, respectively; which were significantly higher than the effective clearance rate for MG 122.5 (± 26.5) ml/min (P < 0.05).

**Conclusion**
MG accumulates to more than 100 fold the normal level in ESRD patients. This accumulation likely reflects 1) its clearance rate (and therefore its reduction ratio) is significantly less than that of urea and Cr, which can be due to its previously described large distribution volume, and 2) increased production from Cr oxidation.
Chronic inflammation has frequently been identified in prostate biopsies, radical prostatectomy specimens and tissue resected for treatment of benign prostatic hyperplasia, yet the relationship between inflammation and prostate cancer has not been established. Earlier, we identified chronic inflammation as a contributor to neoplastic progression in prostate epithelial cells, and hypothesized that its adverse effects were related to an increase in survival protein Bcl2. We hypothesize that changes in the stromal microenvironment, characterized by infiltration of immune cells can induce oxidative stress in the surrounding proliferating epithelium and cause permanent genomic alterations. Currently, we are focusing on several key proteins involved in the inflammatory process, cell survival, basal cell integrity, and evaluated expression of the respective proteins to evaluate possible neoplastic alterations in epithelial cells in an inflammatory environment. Immunohistochemical staining for P63/AMACR cocktail, iNOS, COX2, GST?, and Bcl2 was performed in each set of the biopsies. The integrity of the basal layer was maintained in areas of chronic inflammation with expression of p63 in 72% of these cells. Approximately 68% of luminal cells expressed high to moderate levels of inflammatory markers, whereas 55% of these cells express modest levels of GST? and Bcl2. Interestingly, prostatic glands near areas of chronic inflammation in the PIA lesions exhibit high AMACR and weak p63 expression in basal cells. This resulted in increased inflammatory markers expression, including loss in survival protein expression in adjacent luminal cells. Our findings suggest that basal cells undergo alterations in a setting of chronic inflammation. Basal cells are considered to be progenitor cells capable of differentiating into secretory luminal cells, however under chronic inflammation, they may transform into neoplastic cells that characterize high-grade PIN and prostatic adenocarcinoma.
This study seeks to understand the role of a tumor suppressor protein called Casz1 in the immune system and its relevance to cancer. Previous research in other laboratories has shown that Casz1 is a tumor suppressor protein, and that the lack of Casz1 leads to increased cancer cell proliferation. To further understand the mechanism, we will examine the expression of Casz1 transcription factor in CD4 T cells in response to certain carcinogens and inflammatory cytokines that are known to impact cancer incidence and progression. These experiments will enable us to determine the role of Casz1 in lymphocytes and the contribution of lymphocyte mediated inflammation in cancer.

We will use CD4 T cells isolated from normal mice, activate the cells, and expose them to carcinogens and cytokines, to then examine the Casz1 expression. We will use a variety of molecular techniques, including RNA isolation, quantitative-Polymerase Chain Reaction (qPCR), Nanodrop Spectroscopy, as well as cell culture isolations to obtain and evaluate the results. A carcinogen found in cigarettes and tobacco, known as 4-nitroquinoline-1-oxide, or 4NQO, will be used to induce oral cancer in the mice. Azoxymethane, or AMO, another carcinogen that causes colon cancer, and cytokines IL-6, TNF-a, and IFN-g will also be used.

Our preliminary research shows that Casz1 mRNA is reduced in oral and colon cancer cells, suggesting a negative correlation between Casz1 expression and cancer. Since T cell medicated inflammation is known to be a predisposing factor for cancer, this research is critical for a better understanding of the immune system and the inflammatory pathways connected to cancer regulation.
The purpose of this study was to pilot stimuli material of higher-level language skills to be used as a pre-and post-test for a future intervention research project. A total of 127 stimuli (37 multiple-meaning words, 38 oxymorons, 37 metaphors and 15 paradoxes) were piloted using an Internet-based survey. The study consisted of a total of 263 student participants who are typically developing and between the ages of 12-14. The survey was administered in three different sections. Each survey had a total of no more than 43 stimuli (12/13 multiple-meaning words, 12/13 oxymorons, 12/13 metaphors and 5 paradoxes). Item analysis with a cut off of .26-.75 was followed by item discrimination with an acceptable range of 0.3-1.0. Stimuli that met criteria will make up the pre- and post-testing for the future intervention study that is being designed for students with specific language impairment.
### Abstract

Animals can flexibly and robustly respond to changing conditions in their environment. Understanding the neural mechanism of flexibility could be useful. In the marine mollusk *Aplysia*, previous studies have shown a complex response to mechanical loading during feeding (Hurwitz and Susswein 1992). Animals recruit a stronger muscular response to small mechanical loads to generate more force. If mechanical loads are large enough to injure the animal, it may cut and release food. Can we understand the neural circuitry that mediates these adaptive responses from neural correlates? We have a suspended buccal mass preparation (McManus et al. 2012) in which it is possible to look at neural correlates during swallowing while applying different mechanical loads. We also have a computational model of the feeding apparatus which predicts that it pulls stronger and longer during retraction if load increases (Shaw et al. 2015; Lyttle et al. 2017). As animals switch from grasping food (biting) to swallowing, we have shown increased activity in specific motor neurons that aid in retraction (Lu et al. 2015). Furthermore, our preliminary results suggest that during swallowing, a small increase in mechanical load may recruit additional motor neurons for jaw muscles, whereas a large increase may actually suppress activity in these neurons so the animal may release the food and avoid injury. The interneurons B4/B5 have been shown to have both excitatory and inhibitory connections to these motor neurons (Gardner 1993). Here we study a hypothesized role of B4/B5 in regulating retractor muscle activation under load. These results suggest a neural mechanism whereby animals can flexibly adjust the output of their motor system in response to mechanical load. The neural mechanisms for flexible adjustment may suggest general principles for nervous systems in many other animals.
As inductor technology advances, these components require a new core material to meet the demands of advancing technologies. An improved magnetic core will allow for not only increased efficiency but also a reduction in size and weight and increased operating temperatures. Through alloy development of nanocrystalline magnetic materials, core materials can be greatly improved.

A novel nanocrystalline soft magnetic material, Fe77Co5.5Ni5.5Zr7B4Cu1, has been developed by Knipling and his research group in 2015. While this nanocrystalline alloy having iron substituted with equal percents of cobalt and nickel has resulted in small coercivity and high Curie temperature, magnetostriction persist as the main source of losses. This investigation focuses on increasing the nickel to cobalt ratio in these alloys. Through alloy development, low coercivities and high Curie temperatures can be achieved with eliminated magnetostrictive losses to create an improved magnetic material for high current inductors.

Abstract

To evaluate the association between multivitamin supplements (MS) and the severity of periodontitis in postmenopausal women (PMW) and to delineate demographic, lifestyle factors, anthropometric measurements and pre-existing diseases associated with MS intake. Retrospective, cross-sectional study was conducted using the Case Cleveland Clinic Postmenopausal Wellness Consortium (CCCPWC), a database of over 900 PMW. Subjects were divided into two groups (MS users, n=278; nonusers, n=511) and classified according to periodontal severity: healthy, mild, moderate, and severe. Periodontal parameters included: median number of teeth loss (MNTL), median probing depth (MPD), median recession (MR), and bleeding on probing (BOP). Additionally, anthropometric measurements: body mass index (BMI) and fracture risk assessment tool (FRAX) score, lifestyle factors: MS intake, smoking status, and average alcohol consumption (AAC), socio-economic status: ethnicity, household income, and education level, and pre-existing diseases: secondary osteoporosis, and diabetes were collected. Data were analyzed using the Pearson’s chi-square, and Mann-Whitney U test (\( \alpha = 0.05 \)). Logistic regression model was used to predict the likelihood of MS intake with covariates of interest. Significant differences were found in BOP, MNTL, and FRAX score between MS users and non-users: (73.5% vs. 56.8%; \( p<0.001 \)), (8, 0-32 vs. 5, 0-32; \( p<0.001 \)), and (1.8, 0.5-54.9 vs. 1.6, 0.4-36.2; \( p=0.043 \)), respectively. BMI, and smoking were inversely related with MS users compared to non-users, (25.3, 12.9-53.8 vs. 26.1, 13.5-62.5; \( p=0.049 \)), and (7.6% vs. 19.0%; \( p<0.001 \)), respectively. When adjusting for potential confounders, FRAX score was the strongest predictor of MS intake in PMW (OR 1.8; 95% CI 1.2, 2.8; \( p=0.009 \)). BOP, MNTL, FRAX score, BMI, and smoking are significantly associated with multivitamin supplement intake. MS intake does not appear to significantly influence the severity of periodontal disease in PMW.

Objectives: Serious and preventable medical mistakes are increasingly a concern for both patients and regulatory agencies. Surgical never events are those involving the wrong site, wrong procedure, wrong patient, or a retained foreign object. The incidence of never events in vascular surgery is poorly delineated. Our objective was to ascertain never event rates and classify complications occurring on a vascular surgery service.

Methods: This study is a retrospective review of both medical records and risk management records from a single academic medical center. Using guidelines from the National Quality Forum, we determined if any of twenty-nine unique never events occurred. Review of records also cataloged demographics, past medical history, and context of hospital stay. This allowed for assignment of complications as either an error in technique, error in judgment, error in diagnosis, systems based error, or patient disease.

Results: Over a two year period, 2,149 vascular procedures were performed with 101 complications identified. Review of records found zero examples of never events. Of these 101 complications, there were 23 (1.07%) re-admissions, 22 deaths (1.02%), 16 (0.74%) myocardial infarctions, and 5 (0.23%) strokes. Assignment of error type amongst complications revealed that 66 (65%) cases involved patient disease while 23 (23%) involved errors in technique. When comparing patients transferred for care from an outside institution to non-transferred patients, the difference in the distribution of error types is statistically significant by Chi-square analysis (P = .046). We noted an increased rate of error in technique complications from patients who were transferred.

Conclusions: Despite estimates of widespread never events, we found zero surgical never events over a two year period on a vascular surgery service. Analysis of complication type revealed patient disease and error in technique as the top contributors to complications at our institution.
The identification of vanishing points and the parallel lines that converge thereto is a necessary first step in converting perspective-distorted aerial photographs into orthogonal maps (and a variety of other image-processing tasks relating to perspective transforms). However, in the general case where specific geometric properties of parallel lines cannot be guaranteed, current statistical techniques for line identification perform very poorly and often identify spurious line pairs. We propose a simple neural network to process lines extracted from aerial images and determine whether or not they are indeed parallel and converging to a vanishing point. We show with 95% confidence that this network performs significantly better than chance, demonstrating the feasibility of machine-learning-based approaches in attacking the general problem.
Treatment of castrate resistant prostate cancer (CRPC) has been challenging and continues to remain a significant clinical problem. Although, new generation of drugs and treatment are available for the management of CRPC; however, patients eventually progress with resistance to these therapies. Since research is our greatest defense against cancer and the continuous advancement has been made in cancer research to transform patient care. By continuous research we are deepening our understanding.

**Key Words**
- Castrate Resistant Prostate Cancer
- Androgen Receptor
- EZH2

**Abstract**

Treatment of castrate resistant prostate cancer (CRPC) remains a significant clinical problem. Enzalutamide (ENZ), a novel androgen receptor (AR) antagonist, prolongs overall survival of patients with CRPC; however, patients eventually progress with ENZ resistance. CRPC progression correlates with gain-of-function of the AR and increase in Enhancer of zeste homolog 2 (EZH2), a Polycomb repressive complex 2 (PRC2) subunit, silences gene expression by histone methyltransferase activity. EZH2 is a coactivator for the AR in CRPC, therefore we rationalized that combining an EZH2 inhibitor (GSK126) with an antiandrogen (ENZ) might result in significant reduction of CRPC. To study this, we used human prostate cancer C4-2B3 cells, which are androgen repressed sub-line derived from LNCaP cells injected into castrate nude mouse to form CRPC cells. The nature of the effect of ENZ in combination with the EZH2 inhibitor GSK126 was found by the Chou-Talalay method using CompuSyn software. Data for cell viability measured by MTT for each agent alone and in combination was used in the CompuSyn program to make fraction affected CI (Fa-CI) plots indicating the combination index (CI) values for each drug combo. CI values<1 indicate synergistic interactions, CI values >1 indicate antagonistic interactions and CI values=1 indicate additive interactions. Individual treatment of cells with ENZ and GSK126 between 2.5 to 40µM for 24h demonstrated partial suppressive effect in cell growth with both agents. Strikingly, concurrent blocking of AR and EZH2 at 1:1, 2:1 and 4:1 molar ratio resulted in potentiated toxicity with marked decrease in cell viability and synergistic effect with CI values<1. Further, combination treatment with ENZ and GSK126 resulted in decreased cell migration and induced cell cycle arrest. This study provides preclinical proof-of-concept that combination of an EZH2 inhibitor with antiandrogen may result in prolonged disease stabilization that is resistant to monotherapy.
Perovskite solar cells have drawn much attention and achieved efficiencies over 22%, but very little is known about the long-term stability under photovoltaic operation. So far, stability studies have reported about the importance of degradation of each layer, but little to no consideration has been given to the whole device architecture. We investigated the stability of perovskite solar cells in order to fundamentally understand the mechanism behind efficiency improvement/degradation during device operation. We found that during operation the interface of the perovskite and the electron-transporting layer (ETL), meso-porous TiO2 further intermix with each other, which leads to a boost in the power conversion efficiency (PCE) during the initial operation of these solar cells. The operation-induced structural changes are examined directly by X-ray photoelectron spectroscopy (XPS) with in situ low-energy Ar+ sputtering and time-of-flight secondary ion mass spectrometry (ToF-SIMS) with C60 sputtering. We discovered the primary cause of irreversible degradation is due to ion migration throughout the perovskite solar cell.
Our group is developing a multifunctional composite that possesses energy storage capabilities. Uses we target will include Unmanned Aerial Vehicles, in addition to other applications that require onboard energy storage.

Composite materials offer structural support in many modern applications. It is desirable to design these structures with the added capability of energy storage to save space and weight. While weight considerations are minimal in structures that are permanent in their location, materials that make up things that move are carefully chosen for their physical properties, with a high emphasis on optimizing strength to weight ratios. The work done in association with this project will help integrate energy storage into these materials, thereby transforming them into multifunctional composites, capable of bearing loads as well as being able to store electrochemical energy.

By modifying the geometry of current structures, the loads can be distributed onto the non-active elements of the battery. The internal structure can be optimized to have minimum weight while maintaining the current stiffness. Our group has analytically determined the optimal sandwich structure geometry and determined the maximum energy that can reasonably be integrated into structures. In addition, the group has begun cycle testing energy storage cells for longevity and power output as a baseline for future tests.

Experiments regarding the mechanical loading of energy storage devices in our modified structural building block will be carried out in the future. In addition, flight tests of a modified fixed-wing Unmanned Aerial System utilizing the aforementioned structural composites are anticipated.
This study is aimed at determining whether or not a relationship exists between morality and the choice to defect in a prisoner's dilemma. The prisoner's dilemma is a well-recognized game theory scenario that involves a choice as to whether or not to betray an imaginary partner given a matrix of possible results based on combined decisions. Study participants complete either a morally charged or standard prisoner's dilemma worksheet. The standard worksheet lists varying lengths of jail time as possible punishment. The morally charged worksheet, however, has an outcome involving execution. We predict that those given the morally charged worksheet will be less likely to betray their partner, in spite of the theoretical nature of the exercise.
Birth Asphyxia is a serious global problem and causes nearly one million deaths in newborns worldwide. The incidence of birth asphyxia in newborns requiring hypothermia treatment is estimated to be 4 in 1000 live births, and is nearly 10 times higher in developing countries due to the prevalence of at-home births, lack of hospital access, and other factors. Fortunately, therapeutic hypothermia (TH) has been promising in slowing down the onset of brain damage that is caused by birth asphyxia. In this therapy, the affected newborns are subjected to a controlled reduction in core body temperature to 33.5 degrees Celsius, which initiated within 6 hours of birth and continued for 72 hours and followed by a slow rewarming process. Essentially, reducing the internal body temperature slows the brain metabolism, and therefore hinders further brain damage. Current devices that exist to induce therapeutic hypothermia are large, require a water source, and are only available in certain hospitals. To eliminate these barriers to treatment, our team is developing a portable device to induce therapeutic hypothermia without the need for a water source. The cooling system uses fans for cooling, thermoelectric coolers and heat sinks to further help regulate temperature. Our aim is to make the current device usable in emergency transport vehicles.
Neighborhood Disorganization, Substance Use and Functioning Amongst Adolescents; An analysis of an Ohio Juvenile Justice Initiative

Adolescence is a developmental stage filled with emotional and physical changes that predisposes youth to risky behaviors. Examining the relationships of risk and protective factors such as neighborhood conditions, substance use, social support and functioning will lead to the development of interventions that promotes healthy development and improves health outcomes.

Abstract

Juvenile delinquency is a serious public health concern that places adolescents at risk for poor academic performance, substance use, violence, aggression and teen pregnancy. Approximately 70% of juveniles in the United States legal system struggle with some form of mental health or substance abuse disorder. Little research has examined the health needs of at-risk youth needed to improve long-term health and outcomes particularly with those involved in the juvenile justice system. The purpose of this project is to examine how neighborhood disorganization, social support, and substance use (alcohol, tobacco and marijuana) affects functioning in a sample of adolescents involved in the Ohio Behavioral Health Juvenile Justice Initiative (BHJJ). This project is guided by Bronfenbrenner’s Ecological Transactional Theory of Human Behavior and will analyze the relationships within the microsystem (functioning), mesosystem (social support, substance use) and exosystem (neighborhood disorganization). This descriptive correlational study is a secondary data analysis of the Ohio Behavioral Health Juvenile Justice initiative, a diversion program geared towards 10-18 year old offenders with mental health concerns and behavioral, cognitive or emotional problems. Over 2,500 juveniles have participated in this program to date and this analysis will focus on a subset of these youth with depressive symptoms. Measures include: Substance-Use Survey-Revised (tobacco, alcohol and marijuana use), Youth Information Question (social support), Ohio Youth Problem, Functioning and Satisfaction Scale (daily functional capacity), Neighborhood Disorganization (U.S Census at the zipcode level) and depressive symptoms (Trauma Symptom Checklist for Children). Statistical tests will consist of descriptive statistics, Pearson-product correlation coefficients, independent t-test, multiple regression and path analysis.
Title: SiC Based High Power Broadband Transceiver for Nuclear Magnetic Resonance (NMR) Application

Abstract

Broadband magnetic resonance (MR) front-ends are useful for real-time process monitoring (e.g., food), geological prospecting (well-logging for petroleum and mining), detection of explosives and other illicit materials. By eliminating the effects of limited probe bandwidth, the technique allows robust operation while ensuring good power transmission as well as low-noise reception. In this project, we completely tested a broadband MR transmitter and receiver that can be used widely for NMR measurements. The operating range of this NMR system is 250-750 kHz, which is adequate for many well-logging experiments. The system components include an un-tuned transmit and receive coil, a high durability SiC based switching power amplifier (H-bridge), a switch-based duplexer, and a transformer-based low noise receiver. The coil is wound in three sections with a reversed-polarity central section. The duplexer (consisting of back-to-back FETs) is turned on during transmission; this effectively connects the sections in parallel to maximize B1 for a given transmitter supply voltage (HV). The transmitter uses silicon carbide (SiC) FETs because of their high breakdown voltage (1200V), low on-resistance (~31 miliohm), low switching and conduction losses, and high temperature rating compared to silicon FETs. In addition, it uses symmetric power supplies (HV+ = HV-) to keep the average voltage at both coil terminals close to zero during pulses which improves safety; and reduces residual coil energy, which reduces receiver settling time. The broadband receiver uses an input noise-matching transformer, low-noise JFET-based preamplifier, and active feedback damping circuit to further reduce settling time. Measurements of the receiver reveal a voltage gain 84-90dB and input-referred noise of 0.2-0.3nV/sqrt(Hz) over the operating frequency range (250-750 kHz). The low noise resistance of 2.5-5.5 Ohm ensures good NF (comparable to narrowband receivers) for low-to-moderate Q coils.
Seeking new materials for high efficiency and easy-processing solar cells has always been one of the most important target in renewable energy topic. Organometal halide perovskite, which can be simply spin-coated, has emerged as a promising material for solar cells and optoelectronics. Although the long diffusion length of photo-generated carriers is believed to be a critical factor responsible for the material's high efficiency in solar cells, a direct study of carrier transport over long distances in organometal halide perovskites is still lacking. In this work, we apply the scanning photocurrent microscopy to electrical transport devices of highly oriented polycrystalline organometal halide perovskite CH3NH3PbI3 (MAPbI3) film. The long lateral channel length (ca. 120 um) and Schottky barriers at the contacts allowed us to selectively quantify the minority carrier (electron) transport length and the spatially resolved imaging of photocurrent gave a direct map to visualize the carrier transport characteristic variations over large sample area.
Creating Greater Destinies: Lessons Learned from a Resident Driven Approach to Improve Health, Increase Opportunity and Strengthen Community

Health Improvement Partnership-Cuyahoga (HIP-Cuyahoga) is a consortium focused on reducing health disparities and increasing equity through the creation of safe and supportive environments. HIP-Cuyahoga received funding from CDC's Racial and Ethnic Approaches to Community Health (REACH) program to focus on increasing access and opportunity for healthy eating and active living (HEAL) and improve chronic disease self-management (CDSM) through engagement of various sectors. Six neighborhoods in Cleveland, Ohio, along with the city of East Cleveland, were identified as predominantly African American communities with considerable health disparities linked to lack of healthy food options and physical inactivity. The foundation of this initiative is a resident driven approach. Evidence shows that there is increased engagement and participation when projects have higher levels of resident involvement. Through a community health ambassador collaborative, Creating Greater Destinies, residents prioritized health initiatives that were specifically tailored to the needs of their communities. After completing a 12-week workshop, residents used their experience and knowledge to develop strategies aimed at increasing opportunities for HEAL and CDSM in their neighborhoods. A successful resident driven approach begins before implementation. Utilizing existing community leaders is a pivotal step to a sustainable model. A resident driven approach can change the way community health initiatives think about neighborhoods and set a standard to how public health organizations should look going forward. We will present on lessons learned when working with community leaders, the inclusion of high-level resident engagement, and the importance and need of funding sources that directly support and sustain resident-led initiatives.
The study purpose was to examine literature that described the impact of transitioning from pediatric to adult healthcare on self-management practices during emerging adulthood. Research Questions were the following: (1) Do emerging adults with complex, chronic conditions maintain optimal self-management during transitions?; and (2) What facilitates or impacts self-management during transitions for emerging adults? Inclusion criteria for this literature search were: emerging adults (ages 18-25 years), experiencing transition or preparing to transition to adult healthcare, diagnosed with a complex, chronic condition and published from 2008 to 2016. The literature obtained for this review were obtained from a comprehensive search of databases (PubMed, CINHAL and COCHRANE) using the keywords self-management, young adults, chronic conditions and transitions. Results were a total of 16 studies of emerging adults representing eight complex, chronic conditions met inclusion criteria. The main findings from this literature review include that emerging adults with complex, chronic conditions have difficulty maintaining and prioritizing self-management during transitions from pediatric to adult healthcare. Self-management behaviors decrease and self-management guidelines are infrequently followed during the transition period. Due to feelings of invincibility, emerging adults are often unaware of their physical limitations and fail to consider long-term health complications. Lack of provider support, desire for more health education and feeling rushed during the transition were consistently reported throughout the literature. Assisting with the integration of self-management behaviors into emerging adulthood is not treated as a developmental process increasing the risk of future self-management issues.
Abstract: The desirability of 5XXX series Aluminum-Magnesium alloys for Naval use is tempered by their propensity to sensitize in the application environment. A contributor to this is the Beta Phase (Al₃Mg₂) and non-equilibrium variants that preferentially precipitate at grain boundaries with various thermal exposures. These phases are anodic with respect to the matrix and can corrode and/or provide a path for environmentally enhanced cracking. However, the mechanisms behind this and other phases which may contribute in industrial alloys are less well known. In this study, interrupted tensile tests and microscopy are used to observe how strain accommodation is affected by sensitization in samples from the Short-Transverse (ST) direction of 5083-H116 rolled plates. The ST direction is chosen as it suffers the most severe mechanical degradation from sensitization. Additionally, Differential Scanning Calorimetry is used to characterize materials with different thermal exposures to search for phases that contribute to sensitization in such alloys.
Fracture and Fatigue Crack Growth Behavior of Ti-43Al-4Nb-1Mo after Different Stages of Processing

Ti-43Al-4Nb-1Mo (TNM) is being investigated for potential use in high performance gas turbine engine low-pressure turbine blades. This study summarizes the room temperature fracture and fatigue crack growth of third generation TNM at various stages of production (e.g. as-cast, cast + HIP, HIP + forged, etc.). Tension and bend bar samples were machined from the longitudinal and transverse directions from as-cast, HIPed, HIPed + Forged, and HIPed + Forged + Heat-treated ingots. In addition to tension testing, fatigue crack growth tests were conducted over a range of load ratios, R, in order to determine the load ratio dependence of the fatigue threshold, Paris slope, and stress intensity at overload (Kc) in fatigue. Optical and SEM examination were used to determine the microstructure, fracture path and topography in order to enable comparisons between specimens that experienced different process steps.
Platelet-leukocyte interaction has been implicated in the development of atherosclerosis. Leukocyte integrin Mac-1 has been linked with platelet adhesion and deposition, but its role in atherosclerosis has not been fully studied. Using a carotid partial ligation method to induce endothelial dysfunction and advanced lesion development in mice models, we investigated the interaction between leukocyte integrin Mac-1 and GP Ib? platelet glycoprotein, and its role in the initiation and progression of atherosclerosis. Atherosclerosis formation in strains of mice genetically engineered to have mutated or deleted Mac-1 genes, were compared to a control group. The exhibited decrease in atherogenesis among strains with non-functioning Mac-1 proteins suggests Mac-1 integrin binding is physiologically relevant in the formation and progression of atherosclerosis.
Sintered Cathodes for All-Solid-State Structural Lithium-Ion Batteries

Abstract

All-solid-state structural lithium ion batteries serve as both structural load-bearing components and as electrical energy storage devices to achieve system level weight savings in aerospace and other transportation applications. This multifunctional design goal is critical for the realization of next generation hybrid or all-electric propulsion systems. Additionally, transitioning to solid state technology improves upon battery safety from previous volatile architectures. This research established baseline solid state processing conditions and performance benchmarks for intercalation-type layered oxide materials for multifunctional application. Under consideration was lithium nickel manganese cobalt oxide, a high capacity cathode active material. Pertinent characteristics such as electrical conductivity, strength, chemical stability, and microstructure were characterized for future application in all-solid-state structural battery cathodes. The study includes characterization by XRD, ICP, SEM, ring-on-ring mechanical testing, and electrical impedance spectroscopy to elucidate optimal processing parameters, material characteristics, and multifunctional performance benchmarks. These findings provide initial conditions for implementing existing cathode materials in load bearing applications.
Abstract

Tissue engineering (TE) offers an exciting but relatively untapped modality for repairing large-scale tissue injuries, defects, and diseases. In particular, the long-range goal of cartilage TE research is to produce a tissue that will perform the functions of native articular cartilage, under the same harsh environmental conditions. Comprehensively assessing TE cartilage, and indeed any engineered tissue, is a highly interdisciplinary undertaking. Expertise in many subject areas is required, including molecular and cell biology, biomedical, chemical and mechanical engineering, advanced imaging and computer and statistical modeling. Few labs that focus on TE have the wide range of expertise needed to evaluate their tissues.

The Case Western Reserve University Center for Multimodal Evaluation of Engineered Cartilage draws on our collective expertise in the above fields to develop, validate, and disseminate technologies for monitoring and evaluating the process and the end-product of cartilage tissue engineering to understand the failures that plagues its utility in the clinics.
Refractive error is present in a patient when the shape of the eyes of a patient prevents light from focusing directly on the retina, causing blurry vision. The main types of refractive error are myopia (nearsightedness), hyperopia (farsightedness), presbyopia, and astigmatism. To diagnose patients with specific types of refractive error, ophthalmologists must conduct eye examinations that require the use of expensive devices and a long examination time for the patient. We are creating a device that utilizes an infrared laser diode and a IR sensitive camera in order to screen for refractive error. In our setup, the patient will be at a fixed distance from the device. The patient will focus on the fixation target, while an IR light illuminates the patient's eyes. The device’s camera will be recording images of the patient’s face. From there, the images will be processed, and the size of Purkinje reflections and pupil will be automatically measured. The ratio between the size of Purkinje reflections and pupils’ diameter can be used to derive an approximate refractive error in diopters. Our device will be portable, able to quickly detect myopia and hyperopia, easily operable and will not be dependent on variables such as pupil or crescent size that other eccentric photorefration methods require.
**Abstract**

**BACKGROUND:** Incidence of glioma varies significantly by sex, with a male preponderance. Previous analyses have examined the impact of estrogen exposure as a risk factor for these tumors, with results of varying significance. There may be differences in effect of previously discovered risk alleles that contribute to sex differences. These differences in cancer susceptibility can be leveraged for discovery of variation in genetic effect or unidentified risk factors.

**METHODS:** Using data collected for three previous glioma GWAS in European-ancestry populations (MD Anderson Cancer Center, the San Francisco Adult Glioma Study, and the Glioma Interactional Case Control) we assessed sex-specific effects for 27 glioma risk SNPs overall and for glioblastoma (GBM) and non-GBM tumors separately. There were 3,892 male cases (59% GBM), 4,522 male controls, 2,500 female cases (52% GBM) and 4,940 female controls. Sex-specific odds ratios (ORM and ORF), 95% confidence intervals (95% CI) and p values (pM and pF) were generated using stratified logistic regression models. Data from each study were analyzed separately and combined using inverse variance weighted meta-analysis. Results were considered statistically significant at p<6.2x10^-4.

**RESULTS:** rs11979158 had significant effect in males only in GBM (7p11.2, pM=1.01x10^-10, ORM=1.43 [95%CI=1.28-1.59]; pF=3.43x10^-3, ORF=1.22 [95%CI=1.07-1.39]) and non-GBM gliomas (7p11.2, pM=1.77x10^-5, ORM=1.32 [95%CI=1.16-1.49]; pF=2.73x10^-1, ORF=1.08 [95% CI: 0.94-1.24]). Effect size for rs55705857 (8q24.21) varied significantly by sex, with ORM=2.63 (95%CI=2.24-3.09, pM=4.42x10^-32) as compared to ORF=3.95 (95%CI=3.28-4.76, pF=1.82x10^-47).

**CONCLUSIONS:** Demographic differences in cancer susceptibility can provide important clues to etiology, and can be leveraged for discovery. Significant differences in effect size may suggest variation in genetic effect or unidentified risk factors that vary by sex. Further investigation using an agnostic approach may further elucidate the relationship between effect of risk alleles and sex.
This presentation focuses on an optical method of measuring the resonant frequency and energy dissipation of silicon carbide thin film diaphragms. Physical properties such as the Young's modulus, residual stress, and total quality factors were extracted from resonant frequency and energy loss data. The specimen under test was a metal coated 3C-SiC thin diaphragm fabricated by silicon bulk machining. The diaphragm was mounted on a voltage-driven piezoelectric crystal as the excitation source in a vacuum chamber to eliminate air damping effect. The vibrational displacement of the diaphragm was measured by a modified Michelson interferometer.

The frequency spectrum of the diaphragm was plotted by spanning the driving signal from 50 kHz to 2 MHz. More than 50 resonance peaks were discovered in that frequency band. The Young's modulus and residual stress was derived from high-order resonant frequency data based on a plate-under-tension model. The model relates the Young's modulus and residual stress to diaphragm thickness, side lengths and mode number in sub-micron thick films.

The energy dissipation of the diaphragm was measured by bursting the piezoelectric crystal driving signal at the fundamental frequency of the diaphragm. The vibrational energy decay plot was recorded using Michelson interferometry. The total quality factor Q was derived and the effects of air damping, thermoelastic damping, clamping damping, and solid intrinsic damping were all evaluated.
Serotonin (5-HT) is a major neuromodulator in the brain and disruption of 5-HT signaling has been linked to neurodevelopmental psychiatric disorders including depression, anxiety, suicide, and posttraumatic stress disorder. Although significant progress has been made in understanding the neuron-type specification of 5-HT neurons, far less is known about the regulatory factors that control acquisition of their mature morphological and functional characteristics. Surprisingly, little is known about the intrinsic regulatory factors that control 5-HT axonal growth and guidance. The LIM-homeodomain transcription factor, Lmx1b, plays an essential role in 5-HT neuron terminal differentiation through its activation of 5-HT genes that determines 5-HT neuron transmitter identity. Notably, expression of Lmx1b continues throughout life after the acquisition of 5-HT neuron identity. Thus, we hypothesize that Lmx1b regulates other genes responsible for further features of 5-HT neurons such as their expansive axonal projections. To investigate this, we generated an Lmx1b floxed mouse line that expresses Cre recombinase specifically in newborn 5-HT neurons while simultaneously labeling 5-HT axons with Td-Tomato. Our findings with Lmx1bfl/fl;ePet-Cre;Ai9 conditional knock out (Lmx1bcKO) mice reveal mispositioning of 5-HT cell bodies in the dorsal raphe and a severe disruption of forebrain 5-HT axonal innervation patterns in Lmx1bcKO mice. These findings suggest a major intrinsic role for Lmx1b in 5-HT axonal development and cell body positioning in the raphe. A further goal is to identify Lmx1b regulated genes involved in shaping 5-HT neuron connectivity by performing RNA-sequencing of sorted Lmx1bcKO 5-HT neurons to identify axon growth and pathfinding-related genes controlled by Lmx1b. These experiments will elucidate the mechanisms by which Lmx1b builds 5-HT axon architecture and advance our understanding of how complex 5-HT axon connectivity is achieved during development.
Characterization of Solution-Based Exfoliation of Two-Dimensional Oxide Nanosheets

Delithiation and exfoliation of LiCoO\(_2\) (LCO) and Li\([\text{Ni}_{1/3}\text{Mn}_{1/3}\text{Co}_{1/3}]\text{O}_2\) (LNMCO) into two-dimensional (2D) oxide nanosheets via an aqueous solution-based chemistry route was investigated. Delithiation and exfoliation was achieved by treatment of the powder with hydrochloric acid (HCl) followed with tetramethylammonium hydroxide (TMAOH). Optimization was pursued by altering the particle size, frequency, duration, concentration, and mechanical work. X-ray photoelectron spectroscopy (XPS), X-ray diffraction (XRD), inductively coupled plasma–mass spectroscopy (ICP-MS), and ultraviolet-visible spectroscopy (UV/Vis) were the techniques implemented to characterize the processes of delithiation and exfoliation to 2D oxide nanosheets.
Abstract

One common indicator for undernutrition is stunting which indicates a linear growth retardation and cumulative growth deficit. The initial high prevalence of stunting in Uganda attracted interventions such as the Nutrition and Early Child Development Project that targeted modification of child nutrition-related behavior and practice. This study is aimed to measure the trends of under-five childhood stunting over the past 29 years. It is hypothesized that the prevalence of stunting has been decreasing but differentially by some demographic and residence variables.

Analytic datasets were constructed from the Uganda Demographic Health Surveys of 1988, 1995, 2000, 2006 and 2011 involving 17,659 children. The nine demographic regions in recent surveys were collapsed to the earlier four regions. Using existing z-scores in the database, moderate to severe stunting was defined as > -2 z-scores below the median for WHO and CDC growth standards. SAS software was used to process data, compute, and plot the weighted percentages of stunting in each survey by demographic and residence variables.

Overall stunting has been decreasing each survey, from 48% in 1988 to 33% in 2011. Male stunting percentages are about 7% higher than female ones in all surveys. The highest percentages of stunting are in the 2 year olds while infants have about 20% lower stunting than older children. Stunting among rural children is about 17% higher than that of their urban counterparts. In eastern and northern Uganda, stunting has been steadily decreasing. In western and central Uganda, the trends have been unstable. Among all four regions, central Uganda has the lowest and western Uganda has the highest prevalence of stunting. The sustained overall decrease in stunting from 2000 suggests that measures taken against child malnutrition in the nineties were beneficial. But 3 stunted children in every 10 children is still too high and must be addressed considering demographic variations.
As Cleveland moves toward becoming a more bike friendly city and improves access to physical activity through cycling by increasing the extent and safety of bike facilities, the Clevelanders in Motion Coalition of the Greater Cleveland YMCA is spearheading efforts to create a data dashboard that will warehouse bike-related data collected from city, county and state-level sources. The dashboard will serve as a central location for riders, advocates, planners and policy makers to access data. The dashboard will utilize Bike Cleveland’s website as a sustainable platform to communicate community progress in a dynamic, interactive way by evaluating four priority focus areas: bicycling facilities, ridership, safety and engagement. The Prevention Research Center for Healthy Neighborhoods coordinates these data collection efforts by exploring appropriate sources of data through discussions with community partners such as City and County planning, Northeast Ohio Agency Areawide Coordinating Agency (NOACA), and Safe Routes to School. Primary sources of data that best address the four focus areas were narrowed to the American Community Survey commuter data, the Safe Routes to School program student tally and parent surveys, ODOT bicycle crash data, bike facilities data from Cleveland City Planning and NOACA, the Bicycle and Pedestrian Count Program of NOACA, and participant engagement data from Bike Cleveland. The implementation team, which consists of city-wide partners, came together to develop goals and indicators that would be evaluated using these primary data sources. The goals for each focus area are as follows: facilities-70 miles of new bike lanes by the end of 2017; ridership-double the number of adult bike commuters by 2017; safety-reduce serious injuries by 50% by 2020; and engagement- double participant engagement by 2020.
## Nitrosylation Therapy for Human Organ Storage

### Abstract

On average, more than 75% of transplanted organs are recovered from deceased individuals, the majority of which are classified as brain dead/death (BD) heart beating donors. Five year survival rates for recipients are 80% for kidneys while survival rates are significantly higher for those patients who received their new organ from a living donor. Transplantable renal function following brain death is negatively impacted by inflammation and reduced perfusion, processes regulated by protein s-nitrosylation; this dysregulation continues during storage. In a pre-clinical study we found that repletion of s-nitrosohemoglobin by ethyl nitrite (ENO) improves organ function in swine following brain death. In the present study we set out to determine if addition of an s-nitrosylation agent during renal storage could restore kidney microcirculation and thus improve organ function. Results indicate that addition of an s-nitrosylation agent during renal storage could restore kidney microcirculation which indicated by increase flow rate and decrease resistance. The parameters that were tracked are predictive of post-graft function suggesting a novel method to improve the quality and quantity of kidneys available for transplant.
Introduction: Residents of Cuyahoga County experience poor health outcomes at alarmingly high rates, placing it in the bottom third of all 88 Ohio counties (Cuyahoga County Community Health Improvement Plan, 2015). Communities of color, youth and older adults specifically living in the county’s low-income, low access communities suffer the worst health outcomes. Lack of access to grocery stores in these communities lead to people depending on corner stores for their food choices. In 2013, the Health Improvement Partnership (HIP) – Cuyahoga identified access to healthy and nutritious food as one of its top four health priorities in its Community Health Improvement Plan. Partners including residents, stakeholders, and local store-owners from these communities came together to bring fresh food options to local stores and increase awareness of eating healthy and fresh foods.

Strategy: This video was created collaboratively with community partners to illustrate the issue of access to fresh and healthy foods in low-income and low-access neighborhoods in Cuyahoga County. Community members (young and old), store-owners, community leaders and researchers were interviewed and asked to review the importance of targeting corner stores to improve food access in the county. Community input and recommendations were solicited to ensure the video accurately captures their views and the community need.

Discussion: The Healthy Retail Initiative is part of HIP-Cuyahoga’s Health Matters Here outreach campaign. This campaign is centered on the idea of place-based approach to health disparities and inequities. To ensure everyone has the same chance to be healthy, this campaign tackles social issues like structural racism, and personal challenges, like being able to buy healthy foods in our neighborhoods. The video complements the broader campaign, which encourages community members including residents, businesses, and store-owners to nominate small stores for a healthy makeover through the HIP-Cuyahoga website (http://www.ccbh.info/hipc/about-hip-cuyahoga/health-matters-here-outreach-campaign/). Some of the specific campaign elements include advertisements on and inside buses, in beauty salons, barber shops, laundromats, and local stores; and public service announcements to support the healthy retail initiative. The video is used to educate resident groups, and inspire them to take action and convey the need and demand of ‘healthy foods’ to their local store owners.
Produce Prescriptions for Food Insecure Patients with Hypertension in Safety Net Clinics: A Clinical-Community Linkage

Elevator Speech

Produce prescription (PRxHTN) is an innovative strategy to improve fruit and vegetable consumption among patients and integrates easily within a traditional clinic visit. Through partnerships between clinics and farmers’ markets, PRxHTN provides economic incentives and nutritional education to encourage participants to eat healthy, and promotes the use of farmers’ markets.

Abstract

Introduction Little is known regarding the impact of produce prescriptions for hypertension (PRxHTN) within the context of hypertension visits at safety net clinics. We sought to evaluate intervention effectiveness on patient’s utilization of farmers’ markets (FM) and dietary change related to fruit and vegetable (FV) consumption over 2-3 months.

Methods Health Improvement Partnership – Cuyahoga worked with 3 clinics to integrate, implement, and evaluate PRxHTN, which involves blood pressure measurement, nutrition counseling, and four $10 FM produce vouchers at each of three monthly provider visits. A validated FV survey was administered at visit 1 and 3. PRxHTN voucher use was tracked via FM redemption logs.

Results Of the 224 participants, most were female (72%), African American (97%), with a mean age of 62 years. Over half (62%) had a high school level education or below. 189 participants (84%) visited a FM at least once during the program, with 37% reporting visiting for the first time ever. Average number of FM visits was 2 (range 0-6) and average number of vouchers redeemed was 6 (range 0-12). Among the sub-sample with pre and post survey data (N=140), significant improvement in FV consumption was observed (baseline=15.5, follow-up=19.1; p<0.001). The majority of participants also reported that they tried new FV (79%) because of PRxHTN.

Discussion PRxHTN is a powerful and feasible model for linking safety net clinics with local FM to promote community resources and improve FV consumption among food insecure adult patients with hypertension.
Prostate cancer is the second leading cause of death among men in the United States and metastasis is responsible for more than 90% of prostate cancer-associated mortality. Loss of TIMP3/RECK in prostate cancer is attributed to epigenetic silencing, activating MMPs driving metastasis. We present the effect of green tea in reactivating tissue inhibitors of matrix metalloproteinases (TIMPs) and RECK that are epigenetically silenced in prostate cancer.

Prostate cancer is the second leading cause of death among men in the United States and metastasis is responsible for more than 90% of prostate cancer-associated mortality. Remodeling of extracellular matrix by a family of proteolytic enzymes called matrix metalloproteinases (MMPs) is considered a key for metastasis. MMPs are produced in a latent form (pro-MMP) requiring activation while inhibited by tissue inhibitors of matrix metalloproteinases (TIMPs) and RECK which are novel tumor suppressors. Loss of TIMP3/RECK in prostate cancer is attributed to epigenetic silencing, activating MMPs driving metastasis. Green tea polyphenols (GTP) has been shown to suppress prostate cancer metastasis, reactivate epigenetically silenced genes in cancer cells reducing invasiveness and migration; however the mechanism has not been fully elucidated. In the present study, we demonstrate that GTP mediate epigenetic induction of TIMP-3/RECK plays a key role in suppressing invasiveness and gelatinolytic activity of MMP-2/9 in vivo. Human prostate cancer LNCaP cells were implanted in the ventral prostate of athymic nude mice for 2 weeks and later treated DNA methyltransferase inhibitor, 5-aza-2'-deoxycytidine (AZA), histone deacetylase inhibitor, trichostatin A (TSA) and histone methyltransferase inhibitor, 3-Deazaneplanocin A (DZNep) individually at 0.1 mg/kg body weight intraperitoneally at alternate days/week; and combination of AZA+TSA and DZNep+TSA at similar doses whereas GTP was gavaged at 7.5 and 15.0 mg/kg body weight. Treatment with GTP inhibited tumor growth and its local invasion in dose-dependent manner, compared to treatment with epigenetic inhibitors, their combination after 8 weeks of intervention reducing serum levels of MMP-2, MMP-9 and VEGF. Furthermore, GTP treatment significantly reduced EZH2 and H3K27me3 and class I HDAC protein levels in tumors reversed the hypermethylation status of RECK and TIMP3 gene and significantly enhanced their protein expression in the tumor tissue. Inhibition of VEGF, MMP-2 and MMP-9 levels were also noted after GTP treatment in tumor tissue in dose-dependent manner. Our findings suggest that GTP induces RECK/TIMP-3 that are key epigenetic events necessary for suppression of matrix degradation to suppress invasiveness and subsequent cancer progression.
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**Type**: Poster

**Title**: Device for Rapidly Cooling IV Fluids

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**Elevator Speech**

We are creating a device for rapidly cooling IV fluid during emergency situations in an ambulance. Our device is important because the current approach is to put IV bags in ice, but this doesn’t cool the fluid enough. Our device would cool the fluid as it flowed into the body to maintain a constant temperature.

**Key Words**

- medical
- ambulance
- IV

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**Abstract**

Device for Rapidly Cooling IV Fluids Abstract
Heidi Schmidt (BME), Susan Mostofizadeh (BME), Diana Suciu (BME), Philip Aquila (BME), Stephen Wang (BME)

First responders to trauma incidents must be able to quickly stabilize a patient’s temperature. In recent studies, induced therapeutic hypothermia has been found to mitigate the neurological degradation that follows tissue hypoxia. Currently-prescribed therapeutic, hypothermia treatments rely on utilizing a chilled fluid (3-5 ºC) transferred via intravenous injection to accomplish the task. The target body temperature is 32-35 ºC, even minor cooling can be beneficial to tissue resilience. The purpose of this project is to design and implement a new method for rapidly cooling IV fluid bags in an ambulance. The current method is to run ice-cold saline through an intravenous catheter to cool the patient, which has seen promising results. EMS and First responders are at a disadvantage when it comes to applying this treatment. Working with the limited resources of an ambulance they do not have constant access to refrigeration that hospital trauma units do. In an ambulance this usually means placing the IV bags in buckets of ice until they arrive to the scene. This is not ideal, as not only could the ice bucket lead to a mess in the ambulance, but the bucket is not temperature controlled, the EMTS need to stop for ice on their way to a scene, and eventually the IV needs to be removed from the cold environment to be administered to the patient. Our device is designed to maintain temperature of IV fluid while maintaining a clean environment for EMS workers in the ambulance.

Faculty Mentor: Matthew Williams BME Department
Effect of Human Beta-Defensin 3 on Head and Neck Cancer Epithelial-Mesenchymal Transition

Background: Metastasis is a primary cause of mortality in head and neck squamous cell carcinoma (HNSCC) while Epithelial-Mesenchymal Transition (EMT) is a cellular process that is intimately linked to metastasis. Understanding of the molecular mechanisms that mediate EMT is of pivotal importance. We have shown that cellular transformation at the early stage of oral carcinogenesis leads to generation of the hBD-3 overexpressing tumor microenvironment. Every component in tumor microenvironment had been reported to be associated with EMT in various cancers including head and neck cancer.

Methods: Sc9, SasH1, and SasL1 HNSCC cells were used for cellular morphological observation, scratch wound healing assay, western-blotting assay and immunofluorescence staining.

Results: hBD-3 induces Sc9 cells from a cuboidal to a spindle shape; hBD-3 increases cellular motility as analyzed with wound healing assay, but to a minor extent comparing to the effect from EGF. hBD-3 induces a decreased E-Cadherin and increased beta-Catenin and N-Cadherin expression in Sc9 cells, which are further confirmed by immunofluorescent staining. Among 3 of the transcription factors examined, Snail, twist and ZEB-1, Snail shows a stable upregulation by hBD3. hBD-3 induces p38 as well as mTOR but not AKT signal activation in a different pattern from EGF. While EGF induces EGFR activation at Y1068 and Y1173 residues for p38 and mTOR activation, hBD-3 stimulates Thr-669 -EGFR activation. The pretreatment of cells with p38 and EGFR inhibitors block hBD-3 induced cellular shape and motility change as well as gene expression.

Conclusions: hBD3 induces head and neck cancer EMT through activating EGFR-p38 signaling pathway, which up-regulates Snail, and then further down-regulates E-cadherin and up-regulated N-cadherin as well as beta-catenin.

Support: NIH R01DE025284 (GJ)
Objective: The decision to perform a one or two-stage brachiobasilic arteriovenous fistula (BBF) creation is dependent on factors such as vessel diameter, patient disposition, and surgeon preference. The aim of this study is to examine BBFs constructed with a one-stage transposition technique and a two-stage transposition technique.

Methods: A retrospective review of all patients who underwent construction of a BBF at our institution between 2008 and 2013 was performed. Patients were stratified into one- vs two-stage and primary failure vs mature groups. Patient demographic and access complication data were collected over a 2 year follow-up period and compared across groups. Primary, assisted primary, and secondary patency rates were assessed by Kaplan-Meier analysis.

Results: 49 one-stage and 168 two-stage BBFs were examined in this study. The mean age at time of access placement was 58 (36% male) for one-stage patients and 60 (43% male) for two-stage patients. Pre-operative proximal (4.6 mm ± 1.7 vs 4.0 mm ± 1.5; P= .11), mid (3.6 mm ± 1.39 vs 3.6 mm ± 1.3; P= .93), and distal (3.3 mm ± 1.4 vs 3.4 mm ± 1.3, P= .60) basilic vein diameters were similar between groups (one-stage vs two stage). Kaplan-Meier analysis demonstrated no difference in 2 year primary patency (51% vs 49%; P= .91) and secondary patency (50% vs 61%; P= .58) across one- and two- stage BBFs. Two-stage BBFs trended towards increased 2 year assisted primary patency (66% vs 84%; P= .06). Despite similar complication rates, we observed high rates of catheter infections (14(36%)) within the inter-stage period of two-stage BBFs. Multivariate logistic regression revealed diabetics at higher risk for primary failure (OR 1.71; P = .05).

Conclusion: Several studies comparing one and two-stage techniques for BBF construction have been completed in the past with discordant conclusions. This study contributes to the body of work suggesting that a staged technique does not impact patency.
To further improve the performance and duration of polyacrylate coating materials, it is necessary to obtain a better understanding of the degradation mechanisms. Polyacrylate coatings have significant architectural applications by extending the life of building materials exposed to humidity, UV radiation, and other damaging environmental conditions. For the purpose of studying the life cycle of these coatings, a lifetime and degradation science (L&DS) method is used to quantify and predict the lifetime performance of these materials in a reproducible manner. An analytical approach and L&DS modeling for large data sets presents statistically significant results that describe the performance of the material over a span of time. Network structural equation modeling (netSEM) establishes relationships between the applied stresses and the measured responses. The applied stresses to the material consist of accelerated, simulated environmental exposures based on ASTM G-154 and G-155 testing. Additionally, real-world outdoor exposures are used in association with the indoor, simulated exposures. This implication is significant as establishing an association between simulated and real-world degradation processes of the polymer materials is fundamental to understanding the mechanisms by which the materials and their performance degrade over time. A strong focus is placed on the importance of TiO2 particles and the impact of rutile versus anatase TiO2 crystal structures on polymer degradation. Measured responses of the materials consist of characterization techniques such as FTIR spectroscopy, colorimetry, and specular reflection gloss. Ultimately, data analytics and netSEM modeling demonstrates statistically significant relationships between environmental exposure data and characterization technique measurements for understanding the degradation pathways and improving the performance of TiO2 polyacrylate coating materials.
Abstract

Introduction: Bone mineral density (BMD) is defined as the volumetric density of hydroxyapatite in bones. Low BMD is a risk factor for fractures. Today the gold standard for BMD analysis is Dual-Energy X-ray Absorptiometry (DEXA), a 2D technique that measures the absorption of high- and low-energy x-rays. Low energy x-ray information is necessary to achieve a difference in attenuation between low- and high-density bone. However, as DEXA is a 2D projection method, areas of decreased BMD can be masked when they are overlapped by calcifications or bone outside the spine. A 3D approach like Quantitative CT (QCT) overcomes the overlapping problem, but suffers from inaccuracy due to the lack of low energy information. New Spectral Detector CT (SDCT) may overcome these problems as it can distinguish between high and low-energy x-rays like DEXA and is fully 3D like QCT.

Methods: We used a prototype SDCT to scan test objects: bone or bone-equivalent inserts (K2HPO4) within plastic to emulate a variety of clinically relevant experimental conditions. Images were processed to estimate BMD via regression analysis of the measurements to each test material’s known BMD. A model representing a human lumbar spine was scanned and is being used as calibration for linear regression analysis so that our method can be retrospectively applied to abdominal SDCT’s of 10 patients who also had QCT and DEXA. Correlations between QCT, DEXA and our SDCT method are being assessed.

Results: The accuracy of the SDCT-based BMD estimates was very high (R2 = 0.99) and had a maximum error of 5% for clinical materials. Preliminary retrospective analysis of patient scans shows a high discrepancy (R2= 0.08) between QCT and DEXA BMD values.

Conclusion: BMD values obtained using SDCT are highly accurate for bone-equivalent inserts. The high discrepancy between QCT and DEXA BMD analysis demonstrates the need for a new standard and the potential role of SDCT.
Abstract

Since their initial development in the 1920s, both research and application of aluminum-lithium alloys has greatly expanded. The higher stiffness (~6% increase per 1.0% Li addition) and lower density (~3% decrease per 1.0% Li addition) compared to their lithium-free counterparts is desirable for aerospace applications. These alloys are commonly deformation-processed at high temperatures (T > 300°C) over a moderate range in strain rates (0.01/s < strain rate < 0.1/s) in various forming operations, including forging.

This project characterizes the mechanical and deformation behavior of a new Ag-free aluminum-lithium alloy. The degree of anisotropy of both forged and unforged specimens is analyzed via tension, compression, and Charpy impact tests. Non-destructive acoustic tests are used to accurately evaluate the elastic constants (e.g. Young's Modulus, shear modulus, etc.) of this material in each principle axis. In addition, the effects of changes in temperature, strain rate, and strain on the flow stress evolution are determined on the MTS Advanced Deformation Simulator that resides in the Advanced Manufacturing and Mechanical Reliability Center (AMMRC) at Case Western Reserve University.
The purpose of this study is to describe the changes in spirituality over time, and the effect of personal and contextual factors on spirituality over 14 years in grandmothers in the Midwest. Reed’s Theory of Self-Transcendence (2008) illustrates how people, when exposed to a stressor and increased vulnerability, use self-transcendence to move toward a state of well-being. Spirituality is one way people seek self-transcendence and is associated throughout the literature with positive health outcomes. However, there is little longitudinal data about the stability of spirituality over time, or how health and other personal and contextual factors such as race, age, caregiving, and marital status affect spirituality over time. These questions were examined as a secondary data analysis in a sample of 113 Midwest grandmothers. The participants continued across six time points, fourteen years after their initial study enrollment, making this data set unique in its longevity. Measures included demographics, caregiving status to grandchildren, self-ratings of health and questions to assess both spirituality (importance, comfort found in times of distress) and religiosity domains (religious attendance, frequency of private prayer etc.). RMANOVA indicate that spirituality and religiosity are both stable over time. There were significant between-subjects effects on spirituality and religiosity based on age, race, and self-rated health, but not for marital status or caregiving status. Older women, African-American women, and those with better self-rated health reported greater spirituality or religiosity. This study provides insight about the stability of spirituality over time, the impact of personal and contextual factors on spirituality. These findings may also guide the development of nursing interventions to support spiritual health, as spirituality and its importance can be influenced by people’s personal and contextual factors.
Abstract

Risk factors, such as overexertion, awkward postures, excessive repetition, and the combination of these factors are main causes of work-related musculoskeletal disorders (WMSDs) which are reported to be the leading nonfatal occupational injuries. However, it is difficult for commonly used risk factors identification methods, such as observational methods, to give an objective and comprehensive analysis on these risk factors. To address the above problem, we proposed an automatic WMSDs risk factors identification method based on Wearable and Connected Gait Analytics System (WCGAS). WKGAS was capable of recording plantar pressure from which postures, force exertions, and repetitions could be recognized with algorithms such as sequential minimal optimization (SMO) algorithm and long short term memory (LSTM) network. Experiments with quasi-static and sequential postures were designed to evaluate the recognition performance of work-related motion type (i.e. "lifting", "carrying", "bending", "pulling", and "pushing"). A load variable (with/without 10 Kg load) was introduced for evaluating the performance of force exertions recognition. 5 repetitions of each motion were used for evaluating the performance of repetitions recognition. Results showed that quasi-static postures could be recognized with 100% accuracy and the accuracy for sequential motions recognition were 74%, 79%, 92%, 99% and 99% for "bending", "carrying", "lifting", "pulling" and "pushing", respectively. Force exertions were recognized with 100% accuracy. For repetitions recognition, except the accuracy in the "bending" motion was 80%, the repetitions of other motions could be recognized correctly. These results indicated that it is possible to use WCGAS for WMSDs risk factors identification.
Solid state electrolytes are of interest to replace flammable liquid organic electrolytes due to safety issues. Li$_{3x}$La$_{2/3-x}$TiO$_3$ (LLTO) is a perovskite complex oxide which shows high Li$^+$ ionic conductivity and very high transport number. Certain structural features in bulk LLTO like grain boundaries or domains due to ordering of A-site species where La ions limit vacancy mediated Li diffusion, cause a decrease in ionic conductivity. Epitaxially grown single crystal films are investigated to overcome such limitations and investigate the conduction mechanisms. LLTO films were grown by Pulse Laser Deposition (PLD) on SrTiO$_3$ substrates. Fluence of laser, pulse frequency, substrate temperature and partial pressure of oxygen in deposition atmosphere were the main parameters of the study to control the growth characteristics and rate of the film which was determined by in-situ RHEED. The structure and the thickness of the films were verified by X-ray diffraction and X-ray reflectivity, respectively.
The Use of Complementary and Alternative Medicine by Women with Breast Cancer in Saudi Arabia

Problem Statement: Breast cancer is a significant problem and is the main cause of cancer-related mortality in Saudi Arabia, where it is estimated that the age-standardized incidence rate for breast cancer was 22.4 per 100,000 women in 2008, and the age-standardized mortality rate was 10.4 per 100,000 women. Symptom distress is common and health-related quality of life (HRQOL) is impacted. Although the use of complementary and alternative medical (CAM) therapy is common among breast cancer patients in the US, the use among women with breast cancer in Saudi Arabia is not well understood. Aim: The proposed study will explore the association between symptom distress, HRQOL, and the types of CAM use, as well as to determine the patterns and demographic factors associated with the use of CAM among women with breast cancer in Saudi Arabia. Theoretical Framework: The Symptom Management Theory will be used to guide the study. Subjects: A convenience sample of 85 women with breast cancer will be used. Setting: The study will be conducted in the oncology department at King Faisal Specialist Hospital and Research Centre, in Jeddah, Saudi Arabia. Method: A descriptive cross-sectional study design will be used. The Use of Complementary Therapies Survey (UCTS) and the Memorial Assessment Scale-Short Form (MSAS-SF) will be used to measure CAM use and symptom distress, respectively. Health-related quality of life will be assessed with the Functional Assessment of Cancer Therapy-Breast (FACT-B). Data were collected through face-to-face interviews. Anticipated Data Analysis: SPSS will be used to run descriptive statistics and univariate and multivariate analyses will be used to explore relationships among the CAM use, HRQOL, and symptom distress. Conclusion: The results of this study will guide future studies examining the efficacy of CAM on symptom management and HRQOL in Saudi Arabian women with breast cancer.
Developing a Magnetorheological Fluid Damper for Improved Upper Extremity Dynamics of Stroke Survivors

Abstract

A magnetorheological (MR) damper implemented in conjunction with a stroke-assist brace, as opposed to more simplistic mechanical dampers, holds potential to improve the quality of movement correction. Post-stroke symptoms can negatively impact motor control of 80% of stroke survivors, leaving those affected with a hindering disability and a strong desire for return to human-like biomechanics of the upper extremities. Fluidity is a damper that utilizes magnetorheological (MR) fluid, providing a varied resistance that can help patients regain similar motor control to what they had pre-stroke. Fluidity, in conjunction with a stroke-assist brace, can make what was once the impossible, possible.
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| The SOM Light Microscopy Imaging Core Facility |

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<td>The SOM Light Microscopy Imaging Core maintains a wide range of instrumentation, enabling trained users to perform a variety of imaging experiments. From standard wide field light microscopy to state of the art, diffraction limit-breaking, super resolution microscopy, we have the equipment and expertise to advance your research through visualization.</td>
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**Abstract**

The SOM Light Microscopy Core Facility on the Case Western campus provides shared resources and offers a wide range of services to the research community. Our facilities are committed to enhancing and expanding collaborative capabilities of research in northern Ohio. We are highly trained experts and provide technical expertise, consultation, and training. Our microscopes are conveniently located on the 6th floor (E632) and 5th floor (W512) of the School of Medicine. Imaging techniques available through the core include standard transmitted light microscopy such as brightfield, darkfield, phase contrast, interference contrast, and polarization; standard fluorescence; live-cell long-term imaging; confocal; multi-photon; deconvolution; TIRF; FRAP; FRET; super-resolution, and whole-slide scanning (brightfield and fluorescence). Our range of instruments allows for most types of modern imaging techniques from basic widefield imaging to very high spatial and temporal resolution imaging of fixed and live cells, tissues or small organisms. Image processing capabilities include feature quantification, co-localization analysis, deconvolution, and 3D reconstruction. We are sure that one of our imaging devices can provide the research services you need and assist you in achieving your investigative goals. Arrange for a tour or presentation to your group or department today!
Monocytes play an important role in innate and adaptive immunity to malaria. Human monocytes are classified into 3 subsets according to levels of CD14 and CD16 expression (classical CD14++CD16−, intermediate CD14++CD16+, and non-classical CD14+CD16++). The functional roles of the subsets during malaria infection are still being described. Cryopreserved peripheral blood mononuclear cells (PBMC) were obtained from 12 children in western Kenya at presentation with uncomplicated malaria and 6 weeks following treatment. Phagocytic activity was determined using assays in which CFSE-labeled Plasmodium falciparum-infected erythrocytes (IE) were opsonized with heat-inactivated plasma (pooled Kenyan adult (KA) plasma as a positive control, or malaria-naïve North American (NAM) plasma as a negative control). After incubation of IE with PBMC, the cells were stained with fluorescently-labeled anti-CD14 and anti-CD16 antibodies and subjected to flow cytometry. The percentage of monocytes within a population that had phagocytosed IE was calculated according to the CFSE signal. Opsonic phagocytic activity of all monocytes was decreased during acute malaria compared to 6 weeks following treatment (median 29.8% phagocytosis vs. 43.8%, p = 0.02). During acute malaria, both intermediate and non-classical monocytes displayed greater opsonic phagocytic activity compared to classical monocytes (48.1% and 53.6% vs. 26.4%, p values < 0.01) and greater non-opsonic phagocytic activity compared to classical monocytes (7.6% and 6.7% vs. 4.5%, p < 0.05). Similar patterns were seen in monocytes from 6 week recovery samples. These data indicate that opsonic phagocytic function of monocytes is decreased during acute malaria compared to 6 weeks following treatment. Compared to the classical subset, intermediate and non-classical monocytes were more efficient at phagocytosing IE.
PET provided a detailed insight regarding intracellular changes of glucose metabolism before and after treatment in platinum sensitive and resistant ovarian cancer.
Objectives:
To assess the time course of changes in circulating SNO-Hb levels and physiologic status that occur following brain death in adult organ donors.

Introduction:
Organ Transplant is the treatment of choice for many end stage organ diseases. There's a large gap between the number of the patients on the waiting list and number of transplants perform every year. Major source for organs is brain dead individuals but during donor support, organs often fail or deteriorate and become unfit for transplant.
Organ function following brain death (BD) is negatively impacted by reduced perfusion and increased inflammation. Chemicals called S-nitrosothiols (SNOs) play an important role in regulating perfusion and inflammation.
A better understanding of SNO-Hb bioactivity and donor pathophysiology could increase the number of organs available for transplant.

Methods:
All protocols of the Study have been approved by university IRB and Lifebanc research committee. Donors after confirming brain death will be monitored continuously for tissue oxygenation by T-stat and Hutchinson oxygen monitoring devices. Also serial arterial blood samples will be obtained every 6-8 hours and NO bioactivity will be measured by photolysis-chemiluminscence technique. Data will be analyzed by repeated measures ANOVA and R programming software will be used for statistical analysis.

Results:
So far 28 donors have been included in our study. Mean age is 42.62±16.52y and mean support time is 43.35±25.72h. Based on preliminary results mean SNO-Hb level is 1.33 (CI=1.1-1.57) which is significantly lower than normal values (P<0.001).Median number of expected, recovered and transplanted organs is 6,4 & 3 respectively.

Conclusion:
Initial results indicate SNO-Hb is reduced following brain death and its levels remain constant during the recovery phase and this could be used as a therapeutic target to improve end organ tissue oxygenation and subsequently help us yield more organs for transplant.
Human mesenchymal stem cells (hMSCs) secrete products that are anti-inflammatory and antimicrobial. We have previously shown that hMSCs decrease inflammation and P. aeruginosa infection in the in vivo mouse model of Cystic Fibrosis (CF). CF is a genetic disease in which pulmonary infection and inflammation become the major cause of morbidity and mortality. Understanding how hMSCs improve outcomes in the murine model of Cystic Fibrosis lung infection and inflammation will provide insight into hMSC development for clinical translation. hMSCs secrete products that are specific for managing chronic pulmonary infection and inflammation. hMSCs are active in their environment, secreting products that define the host milieu and capacity to regulate immunity and cellular response. The impact of the hMSCs to down-regulate inflammation is reproducible regardless of the modeling system, using mouse bone marrow derived macrophages or human peripheral blood mononuclear cells. Further, the capacity of the hMSCs to secrete cytokines and respond to pathogen endotoxin (LPS) is impacted by CFTR gene activity. One route of hMSC impact is regulating macrophage peroxisome proliferator activator receptor gamma. hMSCs are environmentally sensitive and proactive, emphasizing the complexity of their function and potential therapeutic impact. Inefficiency of the CF hMSCs in these systems as well as antimicrobial activity data implies that innate hMSC function may be altered in CF. Future studies will pursue the impact of CFTR on hMSC activity and how hMSCs regulate anti-inflammatory and antimicrobial milieu in vivo.
Adopting a Shared Use Policy to Address Physical Inactivity in Under-resourced Neighborhoods

Abstract

Health Improvement Partnership-Cuyahoga (HIP-Cuyahoga) is a consortium focused on reducing health disparities and increasing equity through the creation of safe and supportive environments. HIP-Cuyahoga received funding from CDC’s Racial and Ethnic Approaches to Community Health (REACH) program to focus on increasing access and opportunity for healthy eating and active living (HEAL). Six neighborhoods in Cleveland, Ohio, along with the city of East Cleveland, were identified as largely African American communities with considerable health disparities linked to lack of healthy food options and physical inactivity. In addition, residents in these communities often find themselves without places to exercise safely. To address this, shared use policies in safe community spaces increases resident access to facilities and opportunities for physical activity.

This strategy required an initial assessment of all potential facilities within the priority neighborhoods. A database was created and reviewed with a team of resident, Community Health Ambassadors (CHA), for their input regarding the safety, accessibility, and overall community buy-in regarding the space. REACH Community Fellows also gathered input from community residents to identify spaces within the community that were safe and well trusted. Identified spaces included: churches, community centers, schools, and even a neighborhood cleaners. The sites were approached and asked to sign shared use policies. These policies were designed to promote physical activity programming that would benefit the community.

During this process, 41 community sites were identified by residents and Community Fellows. Of these sites, 29 were invited to sign policies, 16 signed polices were obtained, 14 additional policies are pending, and 2 sites declined the offer to sign a policy. CHAs were instrumental to this process because they showed a genuine connection that links public health research to community priorities.
Purpose: We examined the impact of a 7-year, intentional and targeted initiative aimed at increasing access to healthy food across a large, low-income, urban community (Cleveland).

Methods: Using population-level, locally collected data (e.g., Cleveland BRFSS), from prior to the initiative (2008/2009) and again in 2015, we examined changes in the numbers of farmers’ markets (FM), frequency of FM visits, perceptions of quality and price of food, and consumption of fruits and vegetables (F&V), stratifying results by income to examine effectiveness of the intentional approach (i.e., targeting lowest income neighborhoods).

Results: At baseline, Cleveland had 2.5 FMs per 100,000 residents, and 18.2% accepted SNAP benefits. 49% of households reported incomes of <$25K, with over a third reporting food insecurity (cutting/skipping meals, not enough money for F&Vs); nearly a quarter were dissatisfied with quality and 66% were dissatisfied with price of food in their neighborhood. In 2015, there were 4.8 FMs per 100,000 (compared to 2.5 nationally) and 100% of the markets accepted SNAP (compared to 21% nationally). Residents reported significant increases in frequency of FM visits (i.e., 1+ times a week increased from 13.5% to 18.4%). These gains were more pronounced at lowest incomes levels (i.e., increase in frequent use from 6.3% to 15% for <$15k; from 11.8 to 17.9% for those $15-25k). Satisfaction with quality and price also significantly improved (increased from 27.1% [24.8-29.4] to 42.8% [39.9-45.6] and 9.3% [7.7-11.0] to 17.8% [15.5-20.1], respectively. Overall, there was a small but insignificant increase in fruit consumption; and nearly all change was found among those with incomes <$25k. No significant change was found in vegetable consumption.

Conclusion: Intentional, targeted approaches to increasing community-level access to F&V can be effective - you can build them, and they will come; and those most in need can benefit the most.
Rictor is an essential subunit of mTOR complex-II, maintains the integrity of the complex and functions as full activator of Protein kinase B (Akt). Rictor is involved in progression of malignancies. We aim to determine potential role of Rictor in prostate cancer progression. We demonstrated silencing Rictor in PC-3 cells decreased p- Akt (Ser-473) expression; conversely p-Akt (Thr-308) and p-PKC? (Ser-657) expression was increasing. Using HAP1 cells (derived from male chronic myelogenous leukemia (CML) cell line KBM-7), which were edited and silenced by CRISPR/Cas9 with 2 and 10 base pair Rictor on coding exon 5. In these cells we observed p-Akt (Ser-473) expression was significantly less, which was more pronounced in 10 base pair than 2 base pair. Next, we determined, whether silencing Rictor has any potential role in prostate cancer, we used luciferase tag PC-3 cells silenced with Rictor gene and orthotopically implanted in ventral prostate of mice. After 8 weeks of cells implant, we fed diosmetin to animals in dose dependent fashion (20 and 50ug/animal/day). We observed decreased body weight and wet tumor weight, moreover we observed less luciferase activity; where the cells were implanted. We observed metastasis in control and rapamycin treated mice at spine, lung and kidney, however, no metastasis observed in diosmetin treated mice. Tumor lysate represented decreased Cyclin dependent kinases-2 and 4 with p-ERK1/2 expressions in diosmetin fed mice than control mice. Additionally we observed increased Caspase 9 expression in diosmetin fed animals. Taken together, our studies demonstrate that diosmetin-fed animals resulted in growth inhibition and induction of apoptosis by altering Rictor signaling cascade. We are documenting that these studies are demonstrating the feasibility of growth inhibition and induction of apoptosis by altering Rictor signaling cascade.
Standing neuroprostheses utilizing neuromuscular stimulation enable individuals with spinal cord injury to assume an erect posture. To maintain this position, devices deliver open-loop stimulation to the nerves in the hip, knee, and ankle muscles. To assume task-dependent postures, users must exert upper extremity (UE) forces on a support device and work against their continuously contracting muscles. Enhanced control systems will enable users to access spaces that are difficult to reach from a single posture. We developed a novel proportional-derivative controller that tracked whole-body center of pressure (CoP) location and automatically modulated stimulation as a function of CoP location. The controller was developed to run in the MATLAB®/SIMULINK® R2009b and xPC Target™ toolbox. We hypothesized standing performance with a CoP location tracking controller would exceed open-loop stimulation in terms of UE force required to change postures. One subject with an implanted neural stimulator participated in pilot tests of the controller. The subject stood in an instrumented walker with each foot on a force platform. CoP in the anterior-posterior and medio-lateral directions on the force platforms and UE forces on the walker were captured as he voluntarily adjusted from the erect position to targets located forward, right, left, and diagonally. Kinetic data were sampled at 500 Hz, and all real-time controller parameters were updated at 40 Hz. Two cycles of movement were completed for each direction for a total of three trials. The controller reduced UE force across all five directions. The mean percent reduction in UE resultant force ranged from 18-35%, with the greatest reductions in the left and diagonal right directions. Future work entails collecting repeated trials to quantify stable standing workspace with and without the controller.
Inflammation plays an important role in the pathogenesis of pulpal-periapical (PP) diseases. The production of inflammatory cytokines is regulated through nuclear factor kappa B (NF-kB) pathway. Lunasin is a 43-amino acid peptide containing a unique Arg-Gly-Asp (RGD) cell adhesion motif isolated from soybean. It has been reported that Lunasin inhibits the production of inflammatory mediators by suppressing the NF-kB pathway. However, no study has investigated the anti-inflammatory effect of Lunasin on human-monocytic-cell-line (THP-1) in the field of endodontics. Purpose: to investigate the effect of Lunasin on the production of pro-inflammatory (IL-1?, IL-6, TNF-?) and anti-inflammatory (IL-10) cytokines involved in PP disease. We hypothesized that Lunasin would suppress the production of pro-inflammatory (IL-1?, IL-6, TNF-?) and enhance the levels of anti-inflammatory (IL-10) cytokines. THP-1 cells were plated in wells and differentiated into macrophages(MQ) using phorbol-12-myristate-13-acetate (PMA). MQs were divided into 13 different groups of LPS- and non-LPS-activated and treated with different concentrations of Lunasin (100,50 and 10?M). Levels of inflammatory cytokines were measured using Cytometric-Bead-Array. Data was statistically analyzed using Kruskal-Wallis test (?=0.05). 100?M Lunasin was the only concentration that significantly (P<0.05) reduced the production of IL-1?, IL-6, TNF-?, and increased the production of IL-10 compared to LPS-activated MQ without Lunasin treatment (positive control). Considering the suppressive effect of Lunasin on the production of cytokines responsible for inflammation and bone resorption, the use of Lunasin as a potential anti-inflammatory agent should be evaluated in future studies.
Disordered nitrogen martensite $\gamma^\prime$-(Fe,N), a metastable iron nitride with significant solubility of nitrogen, is an intermediate phase to produce ordered nitrogen martensite $\gamma''$-(Fe,N) in a well-known synthesis route consisting of martensitic and order/disorder transformations. Nitrogen content plays a vital role in this route to make pure bulk $\gamma''$-(Fe,N) phase. Our study examines the effect of nitrogen content on saturation magnetization of this intermediate phase $\gamma^\prime$-(Fe,N). Moderate temperature nitriding (650 C, 700 C) has been performed on both commercial AHC 100.29 water-atomized and custom gas-atomized iron powders using a horizontal tube reactor with flowing ammonia/hydrogen gas. X-ray diffraction technique (XRD) and vibrating sample magnetometer (VSM) were applied to characterize these processed samples. Only samples that consist exclusively of $\gamma^\prime$-(Fe,N) and $\gamma$-(Fe,N) phases were used for magnetization analysis. It is found that saturation magnetization of $\gamma^\prime$-(Fe,N) trends to decrease when its nitrogen content is less than 8.0 at.-%.
In this study, we evaluated and compared the AC magnetic properties of iron oxide-based magnetic hydrogels and plastic composites by measuring their magnetic hyperthermia performance at different excitation field strengths. The iron oxide nanoparticles were synthesized via a thermal decomposition method and were made hydrophilic using a ligand encapsulation process. The nanoparticles were then used as fillers to synthesize glycol chitin-based thermo-responsive magnetic hydrogels, which undergo temperature dependent sol-gel transition. Magnetically responsive plastic composite materials were also prepared by incorporating iron oxide nanoparticle fillers into the polyethylene matrix using an ex situ blending approach and a subsequent compression molding process. The magnetic hyperthermia efficiency of the fabricated magnetic hydrogels and plastic composites were evaluated towards the eradication of bacterial biofilms.

Iron oxide-based superparamagnetic nanoparticles are widely studied due to their biocompatibility and potential in therapeutic hyperthermia treatment or as diagnostic agents. Hyperthermia properties of these nanoparticles are affected by different parameters such as the size and shape of the nanoparticles as well as the matrix (environment) it is placed in. In order to maximize their applications, these material are typically incorporated in different matrices such as hydrogels or composites for...
Year after year, the percentage of elderly citizens has been increasing substantially in the population of the United States. Indeed, many countries, not just the United States, have gradually become aging societies. Therefore, the health and safety issues of the elderly attract more and more attention. Falling is one of the major reasons for the accidental injuries of the elderly, and many times such accidents have irreparable consequences because of the delayed arrival of ambulances. In this project, we propose to attach to a cane an intelligent embedded system with acceleration detection ability. This system will be able to collect the 3D acceleration data of the cane when it is used by the elderly in real time. We will analyze the data in order to detect the fall accidents of the elderly. The system will be able to alert the patient's family or caregivers so that help can be reached immediately after the accident occurs.

As our project has developed, we have also recognized the need to make our device convenient, appealing to the eye, and as user-friendly as possible. To those ends, we have made our device as small as our expertise and the current technology will allow, and have made it incredibly lightweight. Most of the electronics reside in the handle and the electronics are out of sight to make it aesthetically pleasing. As well, the app we have developed has a detailed user interface that allows for the changing of contact information and easy troubleshooting through a "restart the cane" button.
The synthesis of iron oxide nanoparticles (IONPs) via the thermal decomposition method is widely adapted as it gives good control over particle shape and size distribution. However, the as-synthesized nanoparticles are hydrophobic, thereby limiting their use in biomedical applications. In this study, several different types of surface coatings were utilized to render the IONPs hydrophilic, and the corresponding stability and magnetic performance of the different surface coatings were compared. In this study, zinc-doped IONPs with an average diameter of 20 nm were synthesized via a thermal decomposition method using oleic acid and oleylamine as capping ligands. Different surface modification processes were adapted to make the nanoparticles hydrophilic; including the direct oxidation of the capping ligands to introduce functional groups for water solubility. This expands their application in biomedicine.
The success of endodontic treatment depends on the effective reduction of microbes from root canals. However, anatomical complexities such as presence of a middle mesial canal (MM) could make this task more challenging. Various studies have evaluated the prevalence of MM in mandibular first molars (M1). However, no study has investigated the association between anatomy of the mesial root/pulp-chamber floor and the prevalence of MM using CBCT. Purpose: to investigate the prevalence of MM and its association with pulp-chamber floor’s anatomical landmarks. We hypothesized that the longer the distance between MB-ML orifices, the higher the prevalence of MM. After reviewing 351 CBCT records of patients, the following data was recorded: age, presence of MM, MB-ML distance and Weine anatomical classification. Data was analyzed using binary-logistic-regression (?=0.05). The overall prevalence of MM was 5.8%. The mean MB-ML distance was 3.5mm. MM was 2 times more likely to be present in cases when MB-ML distances>3.5mm (OR=2.1; P=0.043). MM was 5 times more likely to be present when MB and ML canals joined-Weine class II (OR=5.2; P=0.001). We also reported that on average, MM orifice was 1.7mm from the danger zone. Anatomical landmarks of the pulp-chamber floor could act as a reliable predictive factor for the presence of MM. This knowledge of anatomical clues may serve to better direct endodontists in locating MM, which could prevent excessive removal of tooth structure.
Titanium is attracting a lot of attention in many fields of engineering due to its useful properties like high corrosion resistance and good mechanical properties.

In this project the main focus is on flat titanium oxide anodic layers, which are very durable, stable and possess colour, due to the thin-film interference of light. Project aim is to create a device capable of printing the oxide layer with high resolution and precise thickness of layer. Last year a working prototype was created and final device is in construction. Possible applications include artistic work and long-lasting, high security data storage.
## Abstract

Nanocrystalline materials, as a result of their extremely small coercivity, high permeability, and low core loss, have been used in soft magnetic applications ever since its discovery over two decades ago. However, the conventional melt-spinning and heat treatment method in core fabrication has limitations in size and geometry of resulting core. To solve the problem, we decide to pulverize the amorphous ribbons obtained from melt-spinning, and sinter them into bulk. In order to prevent unwanted crystallization and keep the powder amorphous, cryomilling technique is used to avoid localized heating during the milling process, so as to inhibit diffusional phase transformations. The superior soft magnetic performances of nanocrystalline alloys are very sensitive to the crystallite size in the amorphous matrix. Regular press and sintering process typically requires prolonged annealing time and involves drastic coarsening, so it is not suitable for our processing, and a fast sintering technique will be required. FAST (Field Assisted Sintering Technique A.K.A Spark Plasma Sintering), which has a very high heating rate, and can achieve a high relative density with much shorter heating time and lower loading is employed. Lower loading required for densification in FAST is also helpful for preserving the good soft magnetic property of nanocrystalline materials when developing them into bulk, since less stress anisotropy will be induced during the process. A number of Fe based nanocrystalline alloys are being developed through the aforementioned route. In this poster, we will be focusing the process of the FINEMET following the method described, presenting the structural information of powder obtained from milling process, relative density and structure of sintered bulks from FAST. We will also show preliminary data of magnetic measurement using VSM on ribbon, powder, and sintered bulks.
Title: The Association of Platelet Count with Outcomes in Pediatric Solid Tumors

Abstract

Background: Metastasis in patients with solid tumors (ST) is associated with poor outcomes. Studies of adult ST correlate thrombocytosis with increased metastatic potential and relapse. Thrombocytosis is also predictive of larger tumor size, nodal invasion and worse outcomes in various adult cancers. However, there are currently no known studies investigating the role of platelets in the outcomes of pediatric ST.

Objective: Delineate the association of platelet count at diagnosis with relapse-free survival (RFS) in pediatric ST. After controlling for tumor type and metastasis, the relationship between platelet count and relapse remained insignificant, despite contrary adult data.

Results: The median platelet count among relapsed patients was 307 X10E9/L (196 X10E9/L - 531 X10E9/L) and was 286 X10E9/L (129 X10E9/L - 963 X10E9/L ; p = 0.22) in relapse-free patients. Poor prognostic factors were identified in 37% of relapses compared to 22.7% of relapse-free patients (p= 0.12). 50% of relapsed patients died, compared to 4% in relapse-free patients (p < 0.001). After controlling for tumor type and metastasis, the relationship between platelet count and relapse remained insignificant.

Conclusion: In contrast to adult data, our retrospective study did not reveal an association between diagnostic platelet count and 3-year RFS in pediatric ST. Some of the limitations include small sample size and varied tumor types. Additional studies are needed to investigate whether these findings are applicable to a larger pediatric population.
Tissues are composed of complex 3D arrangements of cells that express distinct genes and proteins in specific spatial patterns. In recent decades, the use of confocal microscopy has allowed researchers to obtain high resolution 3D digital images of biological tissue, which has advanced our understanding of the spatial arrangements of key biological processes and function. Despite these advances, significant challenges remain in accurately visualizing, processing and quantifying large amounts of digital data. For instance, in order to extract and quantify the expression levels of several genes within each single cells of a tissue, the development of specialized programs requiring extensive coding knowledge is required. Such programs have been developed by individual labs for specific applications and often times cannot be ported for use in separate projects. Thus, it is clear that a standard framework for computational analysis and representation of 3D confocal images is necessary for moving forward. Here we discuss methods of conducting spatial analysis of confocal images using the ArcGIS software environment to apply principles of geographic information science to biological contexts. The GIS environment provides readymade toolsets that can be snapped into automated workflows for spatial and statistical analysis of 2D and 3D data. We used ArcGIS to analyze cell density patterns and gene expression changes in early blastoderm Drosophila embryos and adult brains. Our results with embryos show representations of gene expression patterns and spatial statistics of cell density changes in wildtype and mutants. We also developed 3D tools to depict changes in cell density and expression levels of genes involved in neurotransmitter regulation of the aging adult brains.
Periodontal Clinical Attachment Loss at the Time of Root Canal Treatment: Its Influence on the Survival of Endodontically Treated Teeth

Periodontal and endodontic bacteria communicate through pathways such as lateral canals and dentinal tubules. A significant correlation between apical and marginal periodontal healing has been demonstrated. It has also been suggested that persisting endodontic infections may contribute to progressive periodontal-clinical-attachment-loss (CAL). The outcome of non-surgical-root-canal-treatment (NSRCT) has been associated with various factors. However, the effect of CAL on the survival rate of NSRCT has not been investigated. Purpose: to investigate the association between CAL and NSRCT survival rate. We hypothesized that the more severe the CAL, the lower the survival rate. Computerized analysis was performed for patients who received well-done NSRCT and restoration from 2008-2016 in the graduate endodontic clinic. Data included: dates of NSRCT and CAL measured from CEJ to pocket depth. Included endodontically-treated-teeth (ETT) were divided into 3 groups: CAL 1-3mm(mild-group), 3-5mm(moderate-group) and >5mm(severe-group). To assess survival rate, the time lapse between NSRCT and extraction was recorded. Survival was defined as presence of the ETT in the oral cavity. Data was statistically analyzed using Kaplan-Meier and Cox-regression-time-dependent-model(\(p=0.05\)). The mean CAL was 4.2mm in the extracted teeth and 2.1mm in teeth that survived(\(p=0.023\)). Teeth with severe CAL were 5 times more likely to be extracted compared to the mild-group(OR:5.18;\(p=0.002\)). Patients’ periodontal health, being one of the prognostic determinants of NSRCT, requires more attention prior to NSRCT. This may improve the survival of ETT and help patients maintain their natural dentition.
A series of pre-heated commercial purity (99.9%) polycrystalline magnesium are shock loaded in compression at temperatures ranging from room to near melt point of magnesium and comparable impact velocities in the range 103 to 110 m/s. A decrease in dynamic strength at the impact interface as inferred from the measured particle velocity history at the free (rear) surface of the target plate is observed with increasing specimen temperatures from 23 up to 500 °C; however, in subsequent higher temperature experiments conducted in the temperature of 500 °C and 605 °C, the rate of softening in dynamic strength is observed to weaken. The trend even reversed in the highest temperature experiment (630 °C), a clear increase in particle velocity is observed which is indicative of a net increase in the flows stress of magnesium at near melt temperature, and can be attributed to the transitions in plastic flow mechanisms. Also, unlike all the other cases, the knee in the particle velocity profile representing a transition from elastic response dominated regime to inelasticity regime is hard to be recognized at 630 °C. The effects of grain size and crystallographic texture on the high strain rate deformation behavior are currently under investigation.
Title: The Effect of the Dental Operating Microscope on the Outcome of Nonsurgical Root Canal Treatment: A Retrospective Case Control Study

Abstract

Colleagues for Excellence stated that “as most maxillary-first-molars (M1) have 2 canals in the MB root, case referral to endodontists for microscope-supported-treatment should be considered”. However, Cochrane-systematic-review revealed that no study has investigated the effect of dental-operating-microscope (DOM) on the NSRCT outcome. Purpose: to assess the effect of DOM on the NSRCT outcome with regards to MB root of M1. We hypothesized that NSRCT performed without DOM would be associated with higher incidence of MB lesion on M1. Endodontically-treated M1 with adequate NSRCT/adequate restorations, referred for non-surgical-retreatment at the endodontic department (2008-2016) were collected. Those presented with an periapical lesion (PAI>3) on at least one of the roots were included and divided into two groups: 1) received initial-NSRCT by endodontist/with DOM 2) received by general dentist (GD)/without DOM. Data included: whether MB2 was located initially and presence of MB lesion at the time of retreatment. Data was statistically analyzed using binary-logistic-regression (?=0.05). MB root of M1 was 3 times more likely to present with apical lesion at the time of retreatment if the initial NSRCT was performed by GD/without DOM (OR=3.1; P=0.004). There was a significant association between missed MB2 and MB lesion in the GD group (OR=5.1; P=0.022). However, when performed by endodontists, there was no association between missed MB2 and MB lesion. With proper education, general dentists can gain further insight into recognizing limitations in treating cases that require advanced training and microscope. This strategy may improve the outcome of NSRCT in cases with significant challenges.
**Analysis of Factors Associated with Vertical Root Fracture in Treating Maxillary First Molars: A Risk Analysis Study**

Conservative microscopic endodontic techniques should be utilized in locating and instrumenting MB2 in efforts to maintain the structural integrity of dentin, which is a critical factor in prevention of VRF.

### Abstract

Treating all root canals is an important factor in the success of the nonsurgical root canal treatment (NSRCT). MB root of maxillary-first-molars (M1) often has two canals, thus the inability to treat MB2 could lead to endodontic failure. Efforts to locate MB2 may result in excessive tooth structure removal and subsequent vertical root fracture (VRF). Various factors have been associated with VRF, but no study has investigated the effect of locating/instrumentation of MB2 on the increased risk of VRF.

**Purpose**: to investigate the association between apical-size preparation of MB2 with the risk of VRF occurrence, controlling for confounders. We hypothesized that the larger the MB2 apical-size, the higher the risk of VRF. M1 that received adequate NSRCT/adequate crowns without posts, in the endodontic department between 2008-2016 were collected. Data included: whether MB2 was located, apical-size preparation of MB2 and MB canals, and if extracted, time and reason. Teeth that were extracted due to reasons other than VRF of MB root were excluded. Data was analyzed using cox-regression-time-dependent-model (?=0.05). MB roots in which MB2 was prepared to apical-sizes >25/.04 were two times more likely to be diagnosed with VRF (HR=2.3;p=0.021). However, instrumenting MB2 to sizes ?25/.04 did not increase the risk of VRF of MB roots compared to cases where MB2 could not be located(p=0.43). Conservative microscopic endodontic techniques should be utilized in locating and instrumenting MB2 in efforts to maintain the structural integrity of dentin, which is a critical factor in prevention of VRF.
Current lithium ion battery technologies are facing such challenges including limited capacity, short battery life, significant environmental hazard, and high economic cost. Here we report our most recent progress on research and development of advanced lithium battery technologies for both lithium ion batteries and lithium sulfur batteries with largely increased specific capacity for energy storage. Novel electrode materials are designed and synthesized. Actual batteries are fabricated to test the electrochemical performance. To assist in the design and manufacturing of advanced lithium ion battery technologies, multiphysics electrochemical models are also developed for predictive modeling of battery performance with actual case study conducted on electric vehicles.
Abstract

Purpose: We examined the relationship between the home, school, and neighborhood food environment and dietary intake and diet quality of overweight and obese urban youth.

Methods: Baseline data (n=360) from IMPACT, a 3-year obesity trial funded by NIH, were used. Dietary intake (average calories) and diet quality (Healthy Eating Index) were measured through 3 24-hour recalls using the Nutrition Data System for Research. The Food in Home Index was used to assess food availability in the home, categorizing 16 foods as healthy or unhealthy. Participants reported the availability of calorie-dense foods within schools with the School-Wide Food Practices Scale. Participant’s home and school addresses were linked (ArcGIS) to the PRCHN’s Food Retail Database to assess the proportion of unhealthy food retail within a 0.5 mile of home & school. Bivariate and multivariate linear regression was conducted.

Results: Overall, a significant association between personal and environmental factors with caloric intake was found (p<.001). Gender, unhealthy food availability within the home, and the proportion of unhealthy food retail around the home were all significantly associated with caloric intake. A unit increase in unhealthy foods in the home was associated with a 95 calorie intake increase (p=.04) while an increase in healthy food in the home was associated with an 88 calorie decrease (p=.03). Participants with 100% unhealthy food retail around their home reported 298 more calories than those with no unhealthy retail around their home, controlling for all other variables (p=0.03). There was no association found with school characteristics, the food environment around schools or the association between personal and environmental factors with diet quality.

Conclusions: Results suggest a powerful relationship between a child’s environment and dietary intake, especially the availability of food within the home and the proportion of unhealthy food retail in the neighborhood.
Dental implant surgery can be an invasive procedure with an arduous healing process. This type of surgery is used to replace missing teeth in patients with a crown or bridge, or to implant permanent dentures. Dental screws are used in this type of procedure in order to mimic the root of the tooth within the jaw bone. An abutment and the dental implant needed will then be placed on top of the screw after the screw-bone interface is considered stable and osseointegration has taken place. The process of placing these screws is complex and can heavily affect patient healing time, altering the patient’s use of their mouth for up to six months. A dental torque wrench is used to place dental screws in the jaw after an initial hole is drilled in order to precisely exert the correct amount of torque on the screw based on the torque standards provided by the screw manufacturer. Exerting torque above this recommended optimal torque value can result in screw fracture, while exerting torque below it can result in screw loosening in the jaw. Both scenarios compromise implant stability and can therefore prolong the healing process. The device we have designed aims to provide real-time digital readout of the torque over time as the clinician applies torque to the screw using a dental torque wrench. This information can be used to prevent over and under-torqueing of the dental screw during surgery, which should theoretically improve implant stability and allow the clinician to better predict the healing time.
The Adults and Children Together Raising Safe Kids (ACT) program is an Evidence-Based program of the American Psychological Association and exists to increase participants' knowledge of violence prevention, prosocial parenting practices, effective anger management, calm communication with children and positive discipline practices. The purpose of this study is to determine if the timeframe of an open case with Child Protective Services and/or the stage of readiness to change impact an ACT parenting program participant's success in program completion, attitude and retention of information.

This was a mixed methods study that primarily included up to 20 Child Welfare, Court involved and voluntary participants. Baseline data collected will provide information on the timeframe and orientation of the case at the point of referral. The total timeframe of the study covered two 11 week class sessions held in 2016. Pre and post study measures include the University of Rhode Island - URICA Change Scale, which measured the client's stage of readiness to change. Second, the existing ACT curriculum tests were administered to measure retention of information. Program completion was measured by a minimum attendance threshold of 8 classes as well as participating in the final surveys. Semi structured interviews were conducted with 6 participants to gather qualitative data about the participants' attitude from both participants who successfully completed the program and those that dropped out in order to compare insights and to inquire about feelings and attitude towards participation. By factoring in all of this information we would hope to see an increase in more appropriate referrals and a decrease in drop-out rates due to participants being surveyed on their readiness to participate in the class and learn new information. All of this could lead to a faster completion of case plan and reunification of families.
## Prevention of congenital defects induced by prenatal alcohol exposure using glutathione supplementation

Alcohol use during pregnancy is prevalent, and there is a need to find alternative supplements to prevent congenital heart defects after prenatal alcohol exposure. We have investigated the antioxidant glutathione, which has the potential to significantly decrease observed cardiac defects and impact public health recommendations for pregnant women.

### Key Words
- glutathione
- alcohol
- defect
- cardiac

### Abstract

Alcohol use during pregnancy is prevalent - according to a recent CDC report, 1 in 10 pregnant women reported consuming alcohol in the past 30 days alone. Prenatal alcohol exposure can lead to a variety of defects, including facial dysmorphology, neurodevelopmental problems, growth retardation, and cardiac defects. We have previously examined early and late stage cardiac defects in an avian ethanol exposure model, and we quantified irregularities including abnormal retrograde flow, ventricular wall thinning, and abnormal valve formation using optical coherence tomography. Currently, the methyl donor folate is recommended as a prenatal supplement for women who are pregnant. We studied the effects of folate and another methyl donor, betaine, on early and late stage embryo hearts and found that each compound partially rescued embryos from the defects commonly seen from prenatal alcohol exposure. This study focuses on glutathione, an antioxidant that is active in both methyl donation and oxidative stress - two pathways that are closely regulated during embryonic development. We hypothesized that glutathione supplementation will reduce gross defects and normalize cardiac parameters, including valve leaflet volumes, vessel diameters, and intraventricular septum thickness. Our findings indicate that glutathione has the potential to significantly impact congenital heart defects related to prenatal alcohol exposure, which could have considerable implications for public health.
Titania-Based Polymer Composites for Photoactivated Antimicrobial Applications

Titania nanoparticles (TiO2 NPs) are highly stable semiconductor materials with good photocatalytic properties. Unlike chalcogenide quantum dots, TiO2 NPs are non-toxic and biocompatible, which enable these materials to be used in a wider range of applications. The large band gap of TiO2, 3.2 eV, is considered as a major barrier that prevents its full potential to be employed, especially in photocatalysis as it is only active in the UV region, which only accounts for ~3% of the solar spectrum. One of the few strategies developed to overcome this intrinsic material property limitation is the introduction of non-metal dopants (N and C, respectively called N-TiO2 and C-TiO2) to the TiO2 nanostructure, which lowers the band gap and extends the photocatalytic activity up to the visible spectrum, which covers 44% of the solar spectrum. In our study, we have exploited the enhanced photoactivity of N-TiO2 and C-TiO2 to develop TiO2 NP-based polymer composites for antimicrobial applications. Nanofibers loaded with hydrophilic N-TiO2 and C-TiO2 NPs were fabricated using an electrospinning approach to produce polymer composites with high porosity and large specific surface area. Different types of polymer matrices such as polyvinylpyrrolidone (PVP), polyvinyl chloride (PVC), polyurethane (PU), polycarbonate (PC), and nylon were explored in the development of TiO2 NP-based polymer composites, and the effect of changes in fabrication parameters on the resulting morphology and photocatalytic activities were systematically investigated.

In this study, we explore the visible light activated antimicrobial activities of titania-polymer nanocomposites for potential applications in building wall coatings.
Abstract

Living with a physical disability should not limit your ability to gain muscle or prevent atrophy. Lacking the ability to stabilize themselves while using exercise machines, the physically disabled are unable to effectively make use of all exercise equipment. Additionally, wheelchairs do not provide the stability to allow the users to feel comfortable and confident when lifting large amount of weight. Our team has focused on providing a comfortable and secure method to allow patients with physical disabilities to utilize workout machines to the best of their abilities. By providing a structural seat that attaches to any and all current workout machines, our device provides flexibility and independence for the patient. Once the seat is secured to the exercise machine the user straps in their legs and lower chest. A recliner mechanism with a ball bearing hinge provides a strong and controlled method for adjusting the seat angle. This device provides not only stability when using any exercise equipment, but also confidence and independence in the weight room.
Abstract

Design of electronic system which is part of Ultrasonic imaging system to controls the ultrasound signal emission, beamforming, reception, conditioning and acquisition is introduced. Received electrical signal is processed by using beamforming algorithm like delay and sum, and phase shift beam-former (PSB) to focus or steer the beam in a particular direction using both fixed and dynamic focal points to form an image. Discrete Fourier transform which is an easy way to implement PSB will be presented. The acquired images using PSB for both fixed and dynamic focal points and DFT will be illustrated.
Magnetic nanoparticles have been demonstrated to form chains and cluster assemblies when used for in vivo applications. By preparing a series of selectively organized chains and clusters of iron oxide nanoparticles, we can better understand the behavior of these magnetic nanoparticles when exposed to an AC field, which can be important in therapeutic hyperthermia applications. In this study, we investigated how magnetic dipolar interactions affect the AC magnetic field properties of iron oxide nanoparticles when assembled into chains and cluster formations. The iron oxide nanoparticles were synthesized via a thermal decomposition method. In order to prepare the nanochains and nanoclusters, we used molecular linkers and surfactant molecules, and compared these approaches with carbon encapsulation processes. Using these different methods, we were able to systematically investigate the effect of chaining and cluster formation on the heating efficiency of iron oxide-based nanoparticles.
Apical periodontitis (AP) is associated with increased systemic levels of CRP and IL-6. This systemic upregulation of inflammatory markers could explain the association between some systemic diseases and AP. Epidemiological information has shown that IL-6 plays an active role in End Stage Renal Disease (ESRD) pathogenesis. However, no study has investigated the association between apical periodontitis and ESRD.

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Purpose: to investigate the association between ESRD and AP. We hypothesized that ESRD would be significantly associated with the presence of AP. In this pair-matched, cross-sectional study, 40 patients with non-diabetic-ESRD were included in the study-group and 40 healthy patients with no systemic disease were included in the control-group. AP was defined as the presence of a radiolucency (PAI>3) and further supported by negative vitality tests. Data was statistically analyzed using conditional-logistic-regression (\( \chi^2=0.05 \)). When adjusted for number of remaining teeth, regression-model showed significant association between AP and ESRD. AP in one or more teeth was found in 73% of patients in ESRD group compared to 40% in the healthy/control group (OR=3.9; P=0.004). Interestingly, we also found that 52% of patients in the ESRD group had AP in one or more root-filled-teeth. This number was only 28% in the control group (OR=2.9; P=0.03). At a minimum, AP is epidemiologically associated with ESRD. Taking into account that AP is linked with an increase in systemic levels of IL-6, a mediator associated with pathogenesis of ESRD, AP must be actively sought and treated in ESRD patients.
Background: Demyelinating disorders involve damage to the protective myelin sheath insulating axons, which impedes nerve transmission and in most, leads to the accrual of neurological damage. Multiple sclerosis (MS) is the most prevalent demyelinating disorder. Among affected MS individuals vascular comorbidities (VCs) are common with similar, if not greater, rates than the general population. In MS, VCs contributes to delayed diagnosis, diminished quality of life, accelerated disability accrual, and premature mortality. The prevalence of VCs in other rare demyelinating disorders are unknown. There is also limited information on timing of VC onset with respect to demyelinating disease onset, and the effect of VCs on diagnostic delay in other demyelinating disorders.

Methods: The study population consists of 1587 MS cases, 331 neuromyelitis optica (NMO) cases, 167 transverse myelitis (TM) cases, 30 acute disseminating encephalomyelitis (ADEM) cases, and 682 healthy relative and friend controls participating in the Accelerated Cure Project. Participants reported their age of demyelinating disease onset, age of diagnosis, as well as age of VC onset, where applicable. Information on the following VCs were available: obesity, high cholesterol, hypertension, heart disease, and type 2 diabetes. Diagnostic delay was defined as the time from first demyelinating symptom to diagnosis. Logistic regression models investigated the prevalence of VCs between cases and controls. Linear regression models evaluated the relationships between age of VC onset between cases and controls, and were also used to investigate whether having VCs contributed to diagnostic delays. All models were adjusted for potential confounders and the standard errors were adjusted for relatedness.

Results: Compared to healthy controls, MS cases were more likely have hypertension (OR=1.43, p=0.013) while NMO cases were less likely to have high cholesterol (OR=0.65, p=0.045). Adjusted models failed to observe any differences between cases and controls with respect to age of VC onset. Having a VC significantly delay diagnosis of MS (β=2.2 years, p=9x10-10) and NMO (β=1.2 years, p=9x10-4). The delay in diagnosis of MS was driving by independent effects of high cholesterol and hypertension; while hypertension alone was the primary VC contributing to delay diagnosis of NMO. There were also significant interactions between onset age of MS or NMO with having a VC on diagnostic delays, such that delays in diagnosis became shorter for later onset of MS/NMO. There were no noticeable delays in the diagnosis of TM or ADEM by VC status – however

Elevator Speech: This is the first study to characterize the prevalence of VC in rare demyelinating disorders. Our results suggest the presence of VCs contributes to diagnostic delays for MS, TM, and NMO. Therefore, special attention should be given to patients with VCs presenting with neurological symptoms indicative of demyelinating disorders.
Abstract

Introduction: Caregivers of cancer patients experience increased psychological distress, decreased quality of life, and increased risks of medical illness and death. Several studies have suggested that mindfulness interventions decrease psychological distress and increase quality of life in patients with chronic conditions, health care professionals, and caregivers of dementia patients. However, little is known regarding the effects of mindfulness interventions on informal cancer caregivers. The purpose of this meta-analysis and systematic review is to determine the effects of mindfulness interventions on psychological distress of caregivers’ for hospice cancer patients.

Methods: Electronic databases (PubMed, Embase, Cochrane, and CINAHL) were searched from inception to February 6, 2016 without language restrictions. Studies were included it they were randomized controlled trials, informal caregivers of cancer patients at the end of life, and included mindfulness interventions. For psychological distress, we used a random effects model to calculate the pooled standardized mean difference and 95% confidence interval (CI).

Results: Out of 1672 citations, four studies (N=320) met our inclusion criteria. We found inconsistent results for the use of mindfulness interventions versus standard care to decrease psychological distress in informal caregivers of cancer patients (standardized mean difference = 1.21 and 95% CI = -0.92, 3.34).

Conclusions: Mindfulness had mixed effects on caregivers’ psychological distress. Further studies will help elucidate what aspects of mindfulness interventions are most associated with the greatest effects.
Global Health Design in the Classroom and Beyond

Overview: Students in engineering and anthropology have been working collaboratively since 2015 to design global health technologies to address locally defined needs in Kampala, Uganda. The projects are developed in collaboration with faculty and students at CWRU and Makerere University in Uganda. CWRU students participate in projects through enrollment in an interdisciplinary class, Interdisciplinary solutions to global health issues or as members of the student group, Global Health Design Collaborative (GHDC). We co-teach the course and co-mentor the GHDC. Makerere University students participate as part of their design curriculum.

Design process: The projects are selected and developed employing a process of Collaborative Design, which merges social science approaches to program design and evaluation with the technical design process. In collaborative design, engineers and social scientists work together to identify user needs through extensive fieldwork and engage in an iterative process to design technologies and processes to address global health issues.

Field site: The project field site is Luwero District, Uganda, where we work with local stakeholders who identify needs and participate in co-designing feasible and sustainable solutions. Student teams from Makerere University and CWRU conduct fieldwork at each stage of design.

The projects: Three current projects, each at different stages of design, seek to address three areas of global health priority: medical waste disposal, vaccine cold chain, and pediatric pulse oximetry. One project team is designing a small device to safely remove and incinerate needles used in clinics and health outreach. A second team is designing a more efficient backpack for vaccine outreach that will reduce heat exposure, thus preserving the cold chain. The third project team seeks to design a more effective pulse oximeter for pediatric diagnosis. Current prototypes and design ideas will be demonstrated.
Individuals with spinal cord injury are unable to use traditional motorized wheelchair interfaces which consist of a joystick, buttons, and dials. Restoring the mobility of individuals with spinal cord injuries would vastly improve their independence and thus quality of life. We have designed a portable device which can be attached to a motorized wheelchair and which can manipulate the control joystick based on user electromyography (EMG) signals. We used commercially available EMG sensors, control board, and motors to construct a device which can receive user inputs from muscles in the neck and upper shoulders and move the wheelchair in response. We have investigated the viability of various EMG sensor attachment points and control schemes in regards to accuracy of user intent transduction and ease of use.
The objective of this project is to create a color-changing antiseptic patch that prevents infection at catheter IV sites. One source of infection in intravenous injection sites is disease causing bacteria present on the skin near the injection site. In this design chlorhexidine and a pH sensitive molecule, phenolphthalein is incorporated into the patch’s polysiloxane backing, covering the area around the injection site. This design allows continuous antiseptic release over a period of 72 hours, therefore preventing microbial activity. Phenolphthalein changes from colorless to bright pink when the pH increases to 8.3, indicating the presence of infection causing bacteria. This will alert health-care workers or patient that the injection site is infected. Further analysis will include measuring the release of chlorhexidine in periodic intervals over 72 hours in PBS (pH 7.4) to determine if adequate amounts of antiseptic are released over the entire course of the patch’s use. Future work will also include measuring phenolphthalein’s color response to increased basicity.
Trans Women Seeking Health Care Among Various Cuyahoga County Health Clinics

Our agency was looking to have a better understanding of the disparities of Trans women, so we could know how to help when it comes to healthcare.

Purpose
Health disparities amongst the Lesbian, Gay, Bisexual, and Transgender (LGBT) community are vast and include mental illness, high prevalence of STI’s, HIV, high rates of tobacco, drug and alcohol abuse. Specifically, the Transgender (Trans) population faces a higher rate of disparities compared to other LGBT groups. The Center provides programming to support these disparities including educational programs, STI screenings, mental health counseling, as well as social and emotional support groups. Many Trans specific support groups exist, but have historically lacked in covering the process of accessing healthcare systems. A better understanding of the gaps in healthcare, issues affecting wellness and safety, and the overall experience for Trans women may help The Center to strategically provide support for this population as they engage with the health care system.

Methods
This was a descriptive exploratory study examining what the health care experiences of Trans women in Cuyahoga County. This study utilized two 90 minute focus groups, one consisting of African American Trans women and one of Caucasian Trans women. The study involved a total of 10 focus group participants who were male-to-female transgender and 18 years or older. Participants were recruited through advertising materials via The Center. A focus group interview guide covered topics such as interactions with health clinic staff and physicians, use of preferred gender pronoun and name, and respectful treatment.

Results
Results from the focus group showed that the Caucasian participants had more positive themes regarding interactions with the health care system. The themes in the focus group that included African American Trans females, pointed to more use of illegal ways of coming by hormonal treatments and far less interaction at all with traditional health care.
Animals are very mobile, capable of moving through many different environments. This is possible because of their adaptive nervous systems. Controlling robots with synthetic nervous systems (SNS) may endow them with similar capabilities. An SNS is a dynamical simulation of known and hypothetical neural structures from the spinal cord (for vertebrates) or thoracic ganglia (for insects). These distributed networks generate rhythms for walking, and use sensory information to adapt to the environment. Sparse descending commands from the head modulate these networks to direct walking in a new direction.

There are many different models of how neurons behave. To build our SNS, we use a simple dynamic model. Using a dynamic model enables the SNS to generate rhythms, filter information, and learn from its environment. Using a simple model enables small, low-power computers to run the SNS, making this technology viable for mobile robots in the real world. This poster presents analysis for designing different networks, and shows how the SNS helps a robot adapt to the environment while walking.
Title: Exploring Catalysts Bound with Nitrogenase-based and non-Nitrogenase-based Peptides as an Approach toward Electrochemical Ammonia Production

Abstract:
Due to the fossil fuels used in the Haber-Bosch process, current ammonia production contributes a significant amount to the world’s greenhouse gas emissions. By taking an electrochemical-based approach to this problem, those emissions can be eliminated. However, current catalysts are not selective for the desired reaction. We hypothesize that 3D surface modifications can be utilized to overcome these limitations and create catalysts similar to the nitrogenase enzyme, which enables selective nitrogen reduction to ammonia. Therefore, in this study, peptide sequences have been designed to mimic the general function of the naturally-occurring nitrogenase enzyme. Recent results in a solid-state electrochemical cell show promise using a non-nitrogenase-based peptide, which yielded an electrochemical ammonia production rate that is 10x higher than the catalyst without bound peptide. Encouragingly, gas adsorption isotherms indicate that the non-nitrogenase-based peptide does not block nitrogen adsorption, and catalysts maintain the same surface area after binding to the peptides. Comparing in situ cyclic voltammetry plots from the solid-state cell, nitrogenase-based peptides result in more current, and presumably higher amounts of hydrogen production. Control over peptide loading of the catalyst was demonstrated, and preliminary gas adsorption data of a 2X loaded sample of the nitrogenase-based peptide may indicate higher nitrogen adsorption with samples bound to the nitrogenase-based peptide. The structure and mechanism behind the nitrogenase and non-nitrogenase peptides will be further explored via quartz crystal microbalance with dissipation (QCM-D) in combination with an electrochemical module to give real-time electrochemical and surface information. Furthermore, this promising data could influence general guidelines when tuning the approach of other electrochemical reactions that can be naturally mimicked via enzymatic processes.
Chronic low-grade systemic up-regulation of the inflammatory molecules involving IL-6 and TNF has been associated with adverse pregnancy outcomes such as pre-eclampsia. Therefore, studies have reported an increased risk of developing pre-eclampsia with diseases associated with chronic inflammation such as periodontal disease. It has been proven that apical periodontitis (AP) can act as a source of systemic inflammation. However, no study has investigated the association of AP and pre-eclampsia. Purpose: to evaluate the association between AP and pre-eclampsia. Hypothesis: we hypothesized that AP is significantly associated with an increased risk of pre-eclampsia. In this case-control study, 20 patients with no systemic disease with a history of pre-eclampsia were included in the case group. Also, 20 healthy individuals with no history of pre-eclampsia who were matched regarding age and number of remaining teeth were recruited (control group). AP was defined as the presence of a radiolucency (PAI>3) and further supported by negative vitality tests. Data was statistically analyzed using binary-logistic-regression (p=0.05). The mean number of teeth diagnosed with AP in pre-eclampsia group was 3.4 and 1.6 in healthy/control groups. A significant association was found between the number of teeth diagnosed with AP and pre-eclampsia (adjusted odds-ratio=3.73; 95% confidence interval 1.32-10.58). Based on the results of the present study, it could be suggested that the risk of pre-eclampsia may be reduced through comprehensive dental examinations for detecting and treating any source of inflammation including AP.
Abstract

Nonsense-mediated mRNA decay (NMD) is a cellular process in eukaryotes that acts primarily in the recognition of mRNAs containing premature termination codons (PTCs) and the targeting of these aberrant transcripts for rapid degradation. The core components of the NMD machinery are highly conserved and include the Up-frameshift proteins, UPF1, UPF2, and UPF3. UPF1 is an RNA-dependent ATPase (i.e. ‘RNA helicase’) with known RNA binding activity. We, and others, have demonstrated that UPF1 interacts with both normal and PTC-containing mRNAs, and are interested in better understanding the requirements for the association of UPF1 with mRNA.

In this study, we use sucrose gradient centrifugation (i.e. polysome analysis) to monitor the co-sedimentation of yeast UPF1 with translating mRNA, and to evaluate a role for UPF2, UPF3, and biochemical activities intrinsic to UPF1 for their ability to influence UPF1 association with polysomes. We find that the majority of cellular UPF1 is found on polysomes and that this association of UPF1 with translating RNA does not require either UPF2 or UPF3. We also show that mutations that disrupt the ability of UPF1 to either bind or hydrolyze ATP result in an increase in the amount of UPF1 associated with polysomes, while mutants that prevent UPF1 from binding RNA or UPF2 result in a decrease in UPF1 association with polysomes. Continuing work will be presented on the analysis of additional UPF1 mutants and the interplay between the biochemical activities of UPF1 and the presence of UPF2 and UPF3. Furthermore, we intend to show the effects of UPF1 disruption on the association of UPF2 and UPF3 with polysomal mRNA. Overall, our results provide insight into the requirements for UPF1 to interact with translating mRNA and contribute to our overall understanding of how the NMD machinery surveys and targets substrates to this important quality control pathway.
Schistosomiasis is a prevalent disease with estimated global burden of \( \frac{1}{2} \) billion persons in need of praziquantel treatment as of 2014. Strategies charged of controlling the disease transmission and its morbidity are based on treatment as the primary intervention strategy. An adequate appraisal of the risk of transmission in a given community could foretell whether additional interventions beside treatment are needed.

We developed and analyzed mathematical compartmental model stratified by age and worm burden to appraise the risk of schistosomiasis transmission in a community of 150 villages in Kenya using a statistical model for test-data and Bayesian analysis. Model parameters were specified for different risk categories and used to parametrize a dynamical model that in turn projected the impact of ten mass drug administration (MDA) rounds with community-wide 75% coverage in each risk category. For each risk category, we estimated the probabilities of reducing prevalence of heavy infection (egg counts per gram >100) among school-aged children below 5% following five rounds (WHO-target1) and below 1% following ten rounds (WHO-target2). By simulating 3955 communities obtained from posterior samples of the Bayesian analysis, a broad range of transmission potential was appraised in the Kenyan community and the transmission potential quantified by the basic reproduction number \( R_0 \). Two risk categories were recognized in the analysis and characterized by low-to-intermediate \( R_0 < 2.34 \) and high \( R_0 \) between 2.40-3.69 transmission potential. Dynamic simulations of MDA rounds applied in communities of low-to-intermediate and high transmission potential indicated 100% and 64% probabilities to achieve the WHO-target1, whereas the probabilities for achieving WHO-target2 were 97% and less than 1%.

Additional interventions would be necessary to achieve control in localities with high risk of transmission. Further research is needed to identify these high risk localities.
Heritage data for the class of 9-12% Cr-steels is being investigated with data science to quantify statistically significant relationships amongst multiple processing/microstructure and performance variables. The effort is being undertaken to explore a variety of alloy/processing design questions such as how specific alloying elements produce stable microstructures during creep conditions. Data science not only captures our understanding of the physics controlling performance of 9-12% Cr-steels, it also enhances our understanding by mapping multivariable correlations. The hypothesis is that data science can provide design guidance for new alloy development, now that intuitive design choices are focused on ppm alloy additions.
## Abstract

The purpose of this work is to better understand how animals control locomotion. This knowledge may contribute to the design of more capable and adaptable robot locomotion. To test this hypothesis, we model animals and their nervous systems with dynamical simulations, which we call synthetic nervous systems (SNS). However, one major challenge is picking parameter values that produce the intended dynamics. We present a model of a cockroach that can walk through a simulated environment, whose parameter values were chosen according to the presented design process. The body is actuated by antagonistic pairs of muscles with nonlinear dynamics. A distributed SNS was designed based on pathways known to exist in insects. Each joint’s controller was designed to function as a proportional-integral (PI) feedback loop, and tuned with numerical optimization. This poster describes the design process and the resulting locomotion.
Aim: Compare clinical end points between non-surgical intervention versus preventive therapy. Methods: Of the 60 charts randomly selected from the database, 15 dental implants had non-surgical intervention and 42 implants had preventive therapy. Mann-Whitney U tests were used to compare time from implant placement until time of therapy (T0). Clinical measurements, probe depth (PD), plaque score (PS), and bleeding on probing (BOP), were compared between groups for T0 and healing time (T1). Independent samples t-tests compared PD between the two groups. Fisher’s exact test of independence was used to compare both PD and PS improvement in both groups. Results: A significant difference is found between non-surgical intervention and preventive therapy in length of time from implant placement to T0 (1.8, 0.0-14.0 vs 3.4, 0.4-10.2; p=0.048). There was a significant difference between non-surgical intervention and preventive therapy in maximum PD around the implant at T0 (5.9 ± 0.9 vs 4.1 ± 1.3; p=0.006), difference in maximum PD at the same site around the implant from T0 to T1 (2.0 ± 1.9 vs 0.5 ± 1.41; p=0.004), and average PD around the implant at T0 (3.8 ± 0.6 vs 3.0 ± 0.9; p=0.003). There is a significant association between both average PD improvement (57.1% vs 20%, p = 0.015) and PS improvement (50% vs 6.7%, p = 0.018) in the non-surgical and preventive groups. Conclusion: These findings show that non-surgical treatment has a significant impact on clinical endpoints.
Marama bean (Tylosema esculentum (Burchell) A. Schreiber: Caesalpinioideae) is a perennial non-nodulating legume of southern Africa (Namibia, Botswana and South Africa), growing in poor, arid soils surrounding the western, southern and eastern Kalahari and is being developed as a possible crop for resource poor farmers in arid regions of Southern Africa. Domestication efforts, in conjunction with the University of Namibia, are being spearheaded by the laboratory course Biology 301/401. Students are conducting molecular analyses on this plant to aid the development of high yielding lines for distribution to resource poor farmers in arid regions of Southern Africa. Assembly from whole genome sequencing using both Illumina and PacBio platforms has yielded a complete chloroplast molecule. DNA has been isolated from individual seeds collected across Namibia, which has been sequenced. These sequences have been aligned to the chloroplast genome and intraspecific variation within the chloroplast has been identified. This intraspecific variation has also indicated multiple chloroplast genomes within each individual. This type of intra-individual chloroplast variation, termed plastid heteroplasmy, is rare in legumes.
Flexible and robust neural pathways are ubiquitous in animals. Behavioral flexibility is necessary to survive in unpredictable and changing environments. Previous work has demonstrated that variability in feeding behavior in the marine mollusk Aplysia californica can be useful to the animal – in general, motor components relevant to feeding show higher variability within animals, even as they vary less among different animals. (Cullins et al. Current Biology 2015). In this research, we begin to investigate how to determine common patterns within this variability as a step towards automated analysis of neural recordings for behavioral prediction using a Bayesian network based neural net. Custom Mathematica software was written to carefully map the specific order of activation of different nerves within and around the buccal mass of Aplysia californica during both biting and swallowing behaviors. Results of initial studies showed there is some conserved structure within individual animals and across different animals. We plan to construct a neural net and to train it using the previously described structure along with known information about characteristic rates of firing and spike amplitude of recorded nerves. Should this procedure lead to accurate behavioral classification, it will be of general interest as, in theory, the technique will be implementable within a wide range of biological signal analysis settings.
Abstract

Epilepsy is a neurological disorder characterized by recurrent unprovoked seizures, resulting from impairment of brain function due to abnormal neuronal excitability. Sudden unexpected death in epilepsy (SUDEP) is the most common cause of death in patients with uncontrolled epilepsy with an annual incidence of 1.16 deaths per 1,000. Two major causes for death in SUDEP are probably cardiac and respiratory dysfunction. The central control of respiratory function is mediated by networks in the brainstem which are regulated by the actions of several neurotransmitters and prominent among these neurotransmitters is serotonin. Brain serotonin levels have been shown to play a role in the regulation of seizures. Patients were consented to the study in the Epilepsy Monitoring Unit at the University Hospitals in Cleveland, and blood was collected twice from 44 patients within 5-20 minutes after the occurrence of a seizure (Post-ictal) and after at least 12 hours of seizure-free period (Baseline). Patients were divided into 2 groups based on the type of seizures, generalized tonic-clonic (GTC) seizures (n=17) and non-GTC (n=27). The levels of plasma serotonin measured were higher for post-ictal compared to baseline for the GTC group and was statistically significant (p=0.002). However, there was no difference between post-ictal and baseline levels for the non-GTC group (p=0.919). Age, BMI and seizure duration had no correlation with plasma serotonin levels. Patients with generalized seizures are known to experience increased sympathetic activity, including hypertension, tachycardia, and cutaneous vasoconstriction. Post-ictal dysfunction of serotonin levels may cause decreased breathing and arousal in some patients and this could lead to SUDEP.
Cystic Fibrosis (CF) is an autosomal recessive disorder characterized by a mutation in the cystic fibrosis transmembrane conductance regulator (CFTR). CFTR is an apical chloride channel highly expressed in epithelial tissues, and loss of CFTR function reduces anion and fluid transport to many epithelial surfaces. Intestinal dysfunction in Cystic Fibrosis patients is a prominent source of discomfort and mortality. Loss of fluid transport in the CF intestine causes reductions in gastrointestinal motility, resulting in severe discomfort and intestinal obstruction. CF patients still experience intestinal discomfort despite the use of currently available treatments, indicating that new therapies are necessary. A potential new therapy for intestinal manifestations in CF is Linaclotide, an FDA-approved drug used to treat irritable bowel syndrome in non-CF patients. Linaclotide is an agonist for Guanylate Cyclase C, a receptor expressed in the intestine which activates CFTR through cGMP signaling. This increases fluid content in the intestine, increasing motility and alleviating discomfort. Linaclotide was not prescribed to CF patients because it was unlikely to have any effect due to the absence of CFTR. However, anecdotal reports from CF patients who were prescribed Linaclotide suggest that Linaclotide is effective for alleviating CF intestinal manifestations. The mechanism which underlies this surprising result is unknown. We aim to assess the effectiveness of Linaclotide and determine the mechanism by which Linaclotide improves intestinal phenotypes in the CF intestine.
The flax genome can be rapidly modified within a single generation in response to the growth environment. The variations do not appear to be due to either random mutations or the movement of transposable elements, but rather that the genome appears to be able to switch between two well-defined, different sequences at many loci. The genomes of 9 lines, the progenitor line (Pl) and 8 derived lines (genotrophs) have been compared, by whole genome sequencing, using the flax variety Bethune as the reference genome. The identified differences fall into two main classes. One, where regions of the genome have insertions or deletions (indels) among the genotrophs compared to Pl, the second where Pl and the genotrophs have a large number of SNPs over a short region of the genome. Subsets of these indel variants have been assayed in the progeny from 19 individuals from three different nutrient regimes, from other flax accessions and even the wild progenitor of flax, Linum bienne, have been characterized. In every case the same two alternative structures are seen. What is the source of these variants since they are not present in an intact form in the progenitor genome? Such reproducible large scale variation is unlikely to occur through multiple independent events and therefore an editing mechanism by which long tracts of the genome can be replaced with an alternative structure has been proposed.
New Evidence for Enrichment of Metabolic, Signaling, and Inflammatory Pathways in Age-Related Macular Degeneration

In our lab, we use computer programs to analyze genetic data from individuals with and without advanced age-related macular degeneration (AMD). We hope to identify biological phenomena involved in the disease mechanism of AMD. With this knowledge, more effective therapies may be developed to treat or prevent this disease.

Abstract

The pathophysiology of age-related macular degeneration (AMD) is largely unknown. We aimed to identify biological pathways, molecular interactions, protein families, and regulatory regions enriched for genetic variations associated with AMD. We performed pathway analysis using the Pathway Analysis by Randomization Incorporating Structure (PARIS, V2.4) software tool on 445,115 common and rare variants genotyped as a part of the International AMD Genomics Consortium (IAMDGC). The samples used to generate these data were from 16,144 advanced AMD cases and 17,832 controls. To acquire a more comprehensive understanding of which curated biological and genomic entities contribute to AMD risk, we performed PARIS using multiple biological databases including KEGG, Reactome, GO, NetPath, BioGRID, MINT, Pfam, and ORegAnno. Entities with p-value<0.0001 were prioritized for further study. Preliminary results confirmed several pathways previously implicated in AMD, including the complement cascade, Wnt signaling, and inflammation pathways. Genes previously implicated in the pathogenesis of AMD, such as SYN3, were consistently enriched for significant interactions and regulatory regions identified by PARIS. Preliminary results also showed that 2 genes, PLCG2 and CYP1A1, had significant signals across multiple immune, metabolic, and signaling pathways among the NetPath, KEGG, GO, and Reactome databases. These anchor genes nominate multiple biological pathways and processes in AMD etiology. Further examination is underway to identify the “driver” genes among these phenomena and determine how they may be contributing to AMD risk. This study highlights how the combination of genome-wide genotyping and pathway analysis incorporating in silico functional data can be used to elucidate the genetic architecture of complex eye diseases like AMD.
Stroke affects approximately 800,000 Americans every year and leaves a majority of survivors suffering from long-term physical disabilities. Hemiparesis, which is one-sided weakness, affects nearly 80% of stroke survivors and may manifest itself as hypotonia, or low muscle tone. Hypotonia produces flailing arm movements, causing difficulty in grasping objects or performing precise reaching movements with upper limbs. The project goal is to create an upper extremity assistive device to provide resistance to user-generated movement through utilization of a dampening device capable of guiding uncontrolled motions. The device offers users independence in performing activities of daily living that would otherwise require the aid of a caretaker. The device offers users independence in performing activities of daily living that would otherwise require the aid of a caretaker.
Origami, an ancient form of paper art originated in Japan, still captivates people all over the world. In addition to its aesthetic value, origami is finding its worth in the world of engineering and robotics. A handful of research has proven that origami structures can be useful in deployable devices, shock absorbing devices, actuation and locomotion. Despite such rapid progress in origami-inspired structures, little has been explored in integrating origami into a functional robotic manipulator. Previously, we demonstrated that a specific origami structure--twisted tower--can be successfully integrated to a continuum manipulator, which is capable of multi-DOF movement with cable actuation. However, great human endeavor was required to assemble the whole structure, and inevitable human errors in the fabrication process significantly limited the control and performance of the manipulator. Now, we present a detailed formulation and explanation of the geometric concept behind the origami twisted tower, and introduce a novel prototyping method to parameterize, customize, and fabricate the origami-inspired robot manipulator. By digitizing the paper origami tower and adding customizable parameters, we not only expedited the fabrication process and improved the precision of control, but also opened up the possibility of combining multiple twisted tower geometries in one robotic manipulator, thus increasing the range of motion of the manipulator.
### Abstract

**BACKGROUND**

Massage therapy has an expanding evidence base for treating common health complaints. Studies have shown massage to be effective with back pain, headaches, neck and shoulder pain, stress and anxiety, symptoms of depression, aiding in physical rehabilitation and managing symptoms related to cancer treatment. However, a 2007 National Institute of Health (NIH) survey of US adults found that while use of massage increased among non-Hispanic Whites, racial and ethnic minorities were less likely to have access to massage therapy as part of their health and wellness. Understanding how the public perceives massage therapy and identifying the barriers to access may help determine if integrating massage into primary care, particularly for minority patients would be feasible.

**PURPOSE:**

To describe barriers to access of massage therapy and identify perceptions of massage therapy utilization in Cuyahoga County.

**METHODS**

Our study protocol included a descriptive cross-sectional, anonymous survey in waiting rooms at 5 health clinics in the MetroHealth system. A random sample of 100 patients per facility where asked to participate in the survey delivered via iPad. Surveys were collected in both urban and suburban health centers over a period of 10 weeks.

**RESULTS**

Survey responses show that while most participants were aware of massage, and viewed it as a benefit to their health, respondents from urban clinics were less likely to have had a massage by a licensed massage therapist. Participants cited cost of massage and knowledge of where to go for a massage as a major barrier to access.

**CONCLUSIONS**

Dispelling myths and increasing understanding about the potential benefits of massage as part of health care will be necessary for inclusion of massage. Providing licensed massage therapist as a billable service would help make massage therapy a more viable option for those of lower socioeconomic status, as cost was overwhelmingly seen as the largest barrier to access.
Telomeres are specialized nuclear protein complexes that protect the ends of linear chromosomes from degradation, end-to-end fusions and illicit DNA damage repair. The DNA component of telomeres consists of long hexameric tracts (TTAGGG in humans) of repeating double-stranded DNA sequence (dsDNA) that end in a short single-stranded DNA (ssDNA) overhang at the 3' terminus. The ssDNA overhang is bound with nano-molar affinity by POT1-TPP1 hetero-dimeric proteins. In addition to protecting telomere ssDNA, POT1-TPP1 recruits telomerase, a specialized reverse-transcriptase that synthesizes telomere DNA. Recently a missense variant coding for a mutation in TPP1 (Ala200Thr) was identified in patients with familial melanoma (Aoude et al. (2015)). In this study, we have employed structural and functional techniques to determine the consequences of the TPP1-A200T cancer mutation. To this end, we have solved the x-ray crystal structure of TPP1 oligo-saccharide/oligonucleotide domain harboring the p.A200T mutation. Our structure reveals that the point mutation results in a conformational change of a loop that is predicted to facilitate TPP1 interactions with telomere DNA. Complementing the structural data, we present biochemical and cellular evidence that the p.A200T of TPP1 results in aberrant DNA binding events, thereby diminishing the essential role of the telomere in patients harboring this mutation. Together, our results describe the molecular consequences of the p.A200T cancer mutation of TPP1 protein and our study adds evidence for the importance of ‘case-dependent cancer therapeutics’ approach for treating specific forms of disease.
Abstract

Continued advancement in minimally invasive surgeries coupled with the miniaturization of medical devices places a greater demand on the robustness and reliability of the constituent materials. Enhanced performance requirements of fine wires/strands used as surgical tools or as components of medical devices demand keen attention to material processing. Successful material applications require a strong understanding of the relationship between material composition and processing to the fatigue and fracture behavior. Microscopic material features such as inclusions and voids can contribute to premature failure which may lead to adverse conditions while in use as a tool or as an implanted device. Characterization of these features; therefore, is critical to the overall understanding of the material behavior. In this study, fine wires (<0.200 mm diameter) of superelastic Nitinol were obtained in a standard grade material and a high purity material. The as-received wires were evaluated with various metallographic techniques using longitudinally prepared samples. Correlative microscopy was used to tie conventional bright field microscopy and differential image contrast (DIC) methods to scanning electron microscopy (SEM). To confirm the chemical composition of the matrix, inclusions and/or intermetallic phases, electron dispersive spectroscopy (EDS) and scanning auger microcopy (SAM) were used to provide quantitative elemental analysis and mapping where possible. In addition, specimens were serial sectioned, transversely, with a plasma focused ion beam technique in order to capture the three-dimensionality of the features of interest. Analysis of the inclusions (size, distribution, chemistry) is presented and a comparison of the material grades is discussed.
According to the National Kidney Foundation, 661,000 Americans have kidney failure, 468,000 of which receive treatment in the form of dialysis. A typical dialysis patient will need dialysis three times a week for three to four hours to sustain life, or they may have a kidney transplant. Undergoing dialysis is a painful processing that involves accessing the bloodstream by inserting needles into the patient. Our project aims to create a synthetic access port that is more easily accessible, less-inv
Rechargeable batteries are essential for powering mobile devices, such as electric vehicles and cell phones. While the intercalation anode design in a Li-ion battery provides safety and reliability, it reduces the amount of energy the battery can store in a unit mass or volume. In contrast, the rechargeable lithium metal battery promises greater energy density, but capacity loss during charging and safety hazards have hindered its commercial development for several decades. These problems are commonly attributed to non-uniform deposition, such as the growth of dendrites or whiskers, at the electrode surface. Models for lithium dendrite growth lack a mechanistic account of the role of the solid electrolyte interphase (SEI). This passivating layer of Li salts spontaneously covers the surface of the active Li metal in organic electrolytes, and is believed to play a key role in initiating or suppressing Li dendrites. We hypothesize that the non-uniformity of the SEI layer results in non-uniform current distribution, which initiates dendrites during Li plating. We investigate this hypothesis by employing in-situ optical microscopy of the Li electrode, as well as computer simulations. By perturbing the SEI layer locally, we demonstrate that dendrites preferentially initiate at sites where the SEI layer is thin. Numerical simulations aid the quantification of the effect of SEI non-uniformity on dendrite growth rates. Understanding the role of the SEI on Li dendrite formation will guide future efforts to develop stable Li electrodes for high energy density rechargeable lithium batteries.
Vein Mapping and Fistula Type: A Retrospective Review

Background: Basilic vein transposition (BVT) fistulas are a subset of fistulas used for permanent dialysis access. Vein mapping is an imaging modality used to measure the length and diameter of vasculature. The objective of this study is to determine if the information gained from vein mapping increases BVT fistula maturation rates and days of functional fistula use.

Methods: In a retrospective review of electronic medical records, fistula maturity rates and days of functional use were compared between patients undergoing pre-operative vein mapping and those not. The population consisted of patients undergoing fistula construction within the University Hospitals network from 2008 to 2013. The primary outcome was primary failure, with a secondary outcome of functional fistula days. Propensity score (PS) matching (1:1 greedy) was used to match patients based on demographic data. A secondary analysis, weighting by inverse propensity score, was used to evaluate both outcomes. Missing covariate data was imputed using predictive mean matching.

Results: In 218 patients undergoing BVT fistula construction, 151 patients underwent pre-op vein mapping. Of these, 67 patients were 1:1 PS matched to 67 patients without vein mapping. Following matching, vein mapping was associated with increased rates of primary failure, however the result lacked statistical significance (odds ratio, 1.40; 95% CI, 0.62 to 3.15). Weighting by inverse PS gave an effect size of odds ratio 1.5 (95% CI, 0.38 to 1.97). Among 99 patients reaching functional maturity following BVT construction, 69 underwent pre-op vein mapping. Following matching the effect size was an increase of 71.4 (95% CI, -69.9 to 212.7) days of functional use. Vein mapping was not significantly associated with improved outcomes.

Conclusions: Pre-op vein mapping prior to BVT fistula construction was not associated with increased fistula maturation rates, nor was it associated with increased days of functional use.
Concussions are becoming a serious issue in sports, with about one concussion every two games in the NFL, and over 300,000 diagnoses in the U.S. per year. As a result, researchers are looking for a way to accurately diagnose concussions, especially when the symptoms might be mild. Currently, there are many qualitative tests that have varying success diagnosing concussions, but these tests can produce inaccurate results due to the subjectivity of the methods. Qualitative tests are still standard procedure, however, because there is an apparent lack of quantitative data connected with concussions. We have designed a balance board that improves upon the pre-existing qualitative balance test, adding quantitative data and decreasing its subjectivity. The size and strength of our board has been carefully designed to accommodate the build of any athlete that would need to undergo concussion testing. Our current prototype is carved from wood for mechanical strength and ease of manufacture. By detecting the angle of the board relative to the ground and analyzing the rate of change in the angle, the board will determine if the patient has balance issues in comparison to a baseline. Once enough experimental data has been collected from test subjects, and after the balance analysis algorithm has been refined, this board has the potential to establish a method of accurately measuring the existing, distinct connection between balance issues and concussions.
Feasibility of low contrast dose CT Angiography for Transcatheter Aortic Valve Replacement by using Spectral Detector CT.

Abstract

Introduction: Transcatheter Aortic Valve Replacement (TAVR) is a minimally invasive technique that allows replacement of the aortic valve in patients that cannot tolerate conventional surgery. Prior to surgery, Cardiac CT Angiography (CTA) is used for pre-operative planning, implying the need for injection of a contrast agent. Since aortic valve replacement is primarily performed in an elderly population prone to decreased renal function, injection of contrast agents is a risk factor that can lead to acute kidney injury (AKI), causing increased morbidity and mortality. Therefore a low-contrast dose CT protocol for TAVR planning would be preferable. With the introduction of a new CT technology called Spectral Detector CT (SDCT), we can apply post-processing techniques. Therefore we can create Virtual Monochromatic Images (MI), ranging from 40 to 110 keV, instead of a conventional polychromatic CT image. These MI have the ability to enhance the signal of the intravascular contrast agent.

Methods: A total of 27 CTAs for TAVR candidates were scanned, of which 15 with a standard contrast dose (120 cc), 9 with a low contrast dose (40 cc) and 3 with a reduced (70-100 cc) contrast dose protocol. 2 Blinded readers (Reader 1 and Reader 2) were confronted with MI and conventional CT images, and asked to give their preference. At the level of the aortic valve the image quality was assessed by measuring the signal-to-noise-ratio (SNR) and contrast-to-noise-ratio (CNR).

Results: All of the 27 TAVR surgeries were successful. Reader 1 and 2 most commonly preferred the 60 keV MI (70%) and 40 keV MI (89%) respectively. Overall the SNR and CNR was significantly higher (p=0.00) for the 40 keV MI versus all other MI and conventional CT images. There is no significant difference between the SNR and CNR of the standard contrast dose conventional CT images vs the low contrast dose 40 keV MI.

Conclusion: Low contrast dose cardiac CTA is a feasible method for TAVR planning by using SDCT.
Pressure Ulcers are injuries to the skin caused by prolonged pressure on an area of skin. To solve this problem, we propose a ball and foam system. Displacement measurements of the balls along with pressure mapping technology assist in figuring out how the balls should be arranged in the foam.

Key Words
Cushion
Pressure Ulcer
Biomedical Engineering

Abstract
Pressure Ulcers are injuries to the skin and surrounding tissue caused by prolonged pressure on a particular area of skin for an extended period of time. Around 3 million people in the U.S. are affected by pressure ulcers. They are common for people in wheelchairs and often form around bony parts of the body like the tailbone. Due to the extremely high cost of treating pressure ulcers, it is imperative that prevention methods are explored. To solve this problem, we propose a ball and foam system. There are four major components in this system: cover, foam, balls and straps. The outermost layer is the waterproof cover which helps to prevent potential wetting of cushion and the straps is used to stabilize the cushion on the wheelchair. We will have balls of different strengths. Then finally the foam is used to support the balls and keep them in correct orientation. To test our cushion we will be measuring the displacement of the different balls. Using this knowledge, we will place the balls throughout the cushion in positions that result in maximum pressure relief. We will use pressure mapping technology to better understand where the balls should be placed.
Intracortical microelectrodes have tremendous potential in research and medical applications. However, they suffer from inconsistent recording performance and lifespan which are thought to be caused by a multitude of factors both biotic and abiotic in origin. Furthermore, these failures have been linked to neuroinflammation initiated by blood-brain barrier (BBB) damage during insertion. We found that excessive heat during the craniotomy caused an acute increase in BBB permeability. From our initial studies, we observed that increased BBB permeability (as measured by Evans Blue extravasation) was correlated with longer drilling times. Using an infrared camera, the maximum temperatures and total time of contact during continuous and intermittent (pulsed) drilling was recorded. There was significant variation in trials due to force, feed-rate, angle inherent in hand-drilling technique. From a comprehensive review of methods published in the intracortical microelectrode literature, we discovered that craniotomy methods were inconsistently reported; few studies mentioned specific techniques to prevent drill overheating (10%). Of articles that did report techniques to prevent overheating, cold saline irrigation was by far the most common (83%). Our experimental data showed that craniotomy drilling is capable of increasing the temperature of the brain surface more than 25 °C over the span of 15-20 seconds of contact. Additionally, continuous drilling resulted in a 16.7-fold higher Evans blue eye concentration than the intermittent drilling, suggesting a significant increase of BBB permeability. Future work will seek to determine if the acute increase in permeability of the BBB that we observed influences the neuroinflammatory response. Regardless, to lower the risk and potential impact of drill overheating, it is recommended that craniotomies be performed at a low drill speed, with intermittent on/off application, and with cold saline irrigation.
The goal of this project is to simplify the Compliant Modular Mesh Worm (CMMWorm), a robot designed to move like an earthworm, while maintaining its current functionality by designing a fabric skin. It may be desirable to have interchangeable skins for different environments, which is possible with the fabric skin. It could prevent exterior debris from getting inside of the robot and enable the robot’s exterior to uniformly comply with the terrain. The designed fabric skin eliminates the need for 2/3 of the 3D printed parts and replaces 42 tension springs by using fabric with uniaxial stretch and having sewn channels with flexible tubing passed through them to give the robot structure. The robot is actuated with circumferential cables which decrease the diameter of each segment and therefore cause an extension in length of that segment due to the design of the structure, just as in the CMMWorm. Each segment is contracted and expanded in a particular sequence mimicking the peristaltic motion in an earthworm, which makes the robot move forward. The Fabric Worm Robot is designed so that it can move forward as well as turn similar to the CMMWorm-S. It is less stiff because it has fewer rigid components, it has lower static friction, and it weighs less than the CMMWorm and the CMMWorm-S. The future work on this project will be to incorporate sensors into the fabric skin to provide feedback on how the robot is positioned to control the robot more precisely. In addition, it may be possible to eliminate all the 3D-printed parts by using a fabric skin, which would make it easier to scale down to the actual size of an earthworm.
## Title

*Association between Systemic Diseases and Apical Periodontitis*

## Abstract

**INTRODUCTION:**
To date, the relationships between systemic diseases and periapical microbial infection remain unknown. Thus, the purpose of this systematic review was to evaluate the relationship between host modifying factors and their association with endodontic pathosis.

**METHODS:**
Two reviewers independently conducted a comprehensive literature search. The MEDLINE, Embase, Cochrane, and PubMed databases were searched. In addition, the bibliographies of all relevant articles and textbooks were manually searched. There was no disagreement between the 2 reviewers.

**RESULTS:**
Sixteen articles were identified and included. The overall quality of the studies and the risk of bias were rated to be moderate. Only 3 studies demonstrated a low level of bias.

**CONCLUSIONS:**
The results of this review suggest that there may be a moderate risk and correlation between some systemic diseases and endodontic pathosis. More prospective and longitudinal research in this area is warranted to determine greater specificity in these possible interactions to potentially decrease or minimize the effects of systemic disease on the formation of apical periodontitis.
Behavioral interventions have been used to assist patients in maintaining optimal self-management care of their chronic diseases. However, little is known about the effect of self-management interventions on patient activation for adults with hypertension. Therefore, we conducted a systematic review and meta-analysis to evaluate the effect of self-management strategies on changes in activation levels in adults with hypertension.

**Methods**

We searched PubMed, CINAHL, and Cochrane Central Register of Controlled Trials from January 1st 2004 to March 1st 2016. The patient activation measure (PAM) was developed in 2004 and we wanted to evaluate activation using the PAM. We included randomized controlled trials aimed at assessing self-management interventions on patient activation in adults with hypertension and also reported patient activation using the PAM. Using a random effects model, we combined the studies to calculate the weighted mean difference of PAM scores between the intervention and the usual care group.

**Results**

Of 8022 citations, 4 studies (N=1318 participants) met inclusion criteria. In adults with hypertension, self-management interventions improved patient activation with moderate strength of evidence (weighted mean difference=2.11; 95% CI=0.25 to 3.98). A community-based self-management program and motivational interviewing strategies were associated with better improvements in PAM scores compared to usual care. Patients with higher activation levels are more likely to improve their hypertension self-management behaviors.

**Conclusions**

Behavioral interventions improve patient activation modestly in adults with hypertension. Patient activation can be used as a mechanism to help with hypertension self-management behaviors. These findings reinforce healthcare providers to incorporate these interventions into primary care for patients who have poor hypertension self-management.
**Title**

*Functional Characterization of a Humanized Fecal Microbiota Transplantation (FMT) Model in Gnotobiotic SAMP1/YitFc Mice: A Validation Study*

**Abstract**

Background: Validated, humanized gnotobiotic (hGB), inflammatory bowel disease (IBD) mice models present an exceptional opportunity to conduct proof-of-principal studies that test the effect of microbiota-mediated effects on host immune and metabolic responses. However, the persistence of human flora in mice remains unclear, and in the SAMP1/YitFc (SAMP) model of CD-ileitis, no such literature exists. The aim of this study was to characterize the functional recovery of fecal microbiota isolated from Crohn's (CD), ulcerative colitis (UC), and healthy non-IBD patients and of specific pathogen-free mice donors after FMT in SAMP germ-free (GF) mice recipients, and obtain preliminary data on mechanistic and phenotypic parameters over time. Methods: Five groups (6/group) of young (7-wk), sex-matched, GF SAMP mice were administered 200µL FMT inoculum, or sham, weekly, for 8 weeks. Fecal samples, body weight and diarrhea scores measured weekly. Endoscopic assessment performed baseline, week 4 and sacrifice. Ileum, colon, liver, spleen, stomach and MLNs evaluated through histology (blinded), immunohistochemistry, RT-qPCR, and flow cytometry. Ileal tissues analyzed via 3D stereomicroscopy for MPO assay. Fixed tissues processed for PAS/AB staining. 16s rRNA gene sequencing used to identify bacterial populations. Results: Within 14 days, the CD, UC and non-IBD FMT groups had a significant increase in mean baseline diarrhea scores, with severe dermatitis observed in 3 hGB. Pairwise Friedman's tests showed a significant increase in baseline endoscopic scores by week 4 in the CD and non-IBD groups. Histological analysis revealed a significant decrease in ileitis severity in UC and non-IBD groups, compared to controls. 16s rRNA-based sequencing time-series analyses are in progress. Conclusion: Results suggest differences in phenotypic parameters relative to bacterial colonization adaptations over time, in murine- and hGB mice. Therefore, hGB-FMT mice may represent an excellent model to study functional and metabolic effects of human microbiota.
Low grade gliomas make up a significant proportion of malignant brain tumors and possess a high degree of heterogeneity, highlighting a need for clinically useful markers for prognosis and further biologic investigation. We used an existing model of biological age based upon DNA methylation to characterize epigenetic age in low grade gliomas (LGG) according to existing classification methods and assessed its prognostic utility. We analyzed data from TCGA LGG cohort, consisting of 516 patients; 216 grade 2 and 241 grade 3 tumors. Age at diagnosis ranged from 14-87 years with median age 43. We calculated “DNA methylation age” (DNAm age) based upon 353 CpG probes according to the epigenetic clock developed by Steve Horvath, and calculated age acceleration according the DNAm age of tumor tissue relative to reported chronological age at diagnosis. DNAm age was assessed for prognostic value using Cox proportional hazards regression. Age acceleration differences were assessed across LGG classification methods using the Wilcoxon Ranked Sum test. DNAm age remains highly correlated with chronological age in LGG tumor tissue (cor=0.58, p<0.001), with an average age acceleration of 33.5y. DNAm age provided prognostic power over age and Karnofsky Performance Score (p=0.003), but not over inclusion of IDH mutation status in the model. Further investigation showed significantly increased age acceleration in IDH-mutant compared to IDH-wt tumors (95% CI= 18.6-28.8y) as well as MGMT-promoter methylated versus unmethylated (95% CI= 18.1- 28.9y). Although the regulation of DNAm age in cancers remains poorly understood, significant association of DNAm age acceleration with prognostically useful molecular subtypes in LGGs underscores biological differences that cannot be discerned in LGGs. This association suggests that LGGs may provide an avenue for investigating DNAm age, molecular subtype, and their relation to tumor behavior and clinical prognosis.
Extracellular Vesicles Derived from HIV-infected T cells Induce Human Beta-Defensin-3 Expression and Promote HNSCC Growth and Progression

Extracellular vesicles derived from HIV-infected T cells induce Human α-Defensin-3 expression and promote head and neck Squamous cell carcinoma growth and progression. HIV TAR RNA loop region is critical for promoting cancer cell proliferation and hBD-3 gene expression induced by HIV-infected T-cell EVs.

**Abstract**

Background: Human α-defensins (hBDs) are small cationic peptides originally identified from plasma of patients with renal disease and from psoriatic skin lesions as antimicrobial molecules of the innate immune system. HIV-infected T cells produce a variety of immunologically active extracellular vesicles (EVs). To identify HIV-specific mechanisms for the development of novel therapeutic approaches in the population, we investigated the role of EVs derived from HIV-infected T cells in hBD-3 gene expression and head and neck cancer (HNC) progression.

Methods: EVs were isolated from conditioned media of HIV-infected Jurkat cells (J1.1, 8E5/LAV) and non-infected control cells using the ultracentrifugation protocol. HNC cells UM-SCC-104, TR146, HSC3, and SCC9 were treated with EVs for cell growth, migration and gene expression in vitro and in vivo. HNC cells were transfected with EV cargo TAR RNA for hBD-3 expression and identification of signaling pathways.

Results: 1) EVs isolated from HIV-infected Jurkat cells (HIV+ EVs) significantly stimulated HNC cell proliferation, migration and invasion; 2) expression of the hBD-3 transcript was induced by EVs from HIV-infected T cells; 3) HIV TAR RNA, but not its mutant form, significantly induced hBD-3 expression in HNC cells; 4) hBD-3 expression induced by HIV TAR RNA was blocked by an RNA aptamer targeting TAR RNA; 5) TAR RNA induced hBD-3 expression in HNC cells through TLR3.

Conclusion: Extracellular vesicles derived from HIV-infected T cells induce Human α-Defensin-3 expression and promote head and neck Squamous cell carcinoma growth and progression. HIV TAR RNA loop region is critical for promoting cancer cell proliferation and hBD-3 gene expression induced by HIV-infected T-cell EVs.

Acknowledgement: This research is supported by NIH R01DE025284 (G.J., gxj7@case.edu)
Background: Interleukin-1 (IL-1) has been proposed as a key inflammatory mediator in both experimental and human inflammatory bowel disease. The role of IL-1α in intestinal inflammation is unclear. The aim of this study was to determine the effects of specific IL-1α neutralization in SAMP1/YitFc (SAMP) ileitis and whether these effects are mediated by alterations in the gut microbiome.

Methods: Specific pathogen-free (SPF) and germ-free (GF) SAMP mice, treated with an anti-IL-1α (FLO1) monoclonal antibody (100μg; 2x/wk for 4 wks), were compared to age/gender-matched SAMP treated with dexamethasone (Dex, 1mg/kg/day for 1 wk) and untreated controls. Using 3D-stereomicroscopy, ileal tissues of uninvolved and involved morphology were assayed for myeloperoxidase (MPO) activity, IL-1α and IL-8 mRNA levels, and ileitis severity by histology. Fecal microbiome was analyzed using 16S rRNA gene sequencing.

Results: SAMP mice displayed increased levels of IL-1α and IL-8 mRNA expression in involved ileal areas. FLO1-treated SPF mice showed a significant reduction in inflammatory scores (vs. controls), with similar efficacy to Dex treatment. MPO activity was significantly decreased in treated mice vs control. IL-1α blockade had no anti-inflammatory effects in GF mice. 16S rRNA gene analyses revealed alterations in bacterial communities in the IL-1α blockade and Dex-treated groups versus controls. Of those significant, 3 taxa were significantly reduced after Dex, compared to control and IL-1α. Of interest, there were taxa uniquely present in the IL-1α blockade (iii1-15, armatimonadales), and a significant number of other unidentified microorganisms.

Conclusions: Specific IL-1α neutralization ameliorates the severity of ileitis in SPF SAMP mice, but has no effects in GF SAMP mice. Our results suggest that alterations in gut microbiome composition may contribute to the anti-inflammatory effects of IL-1α blockade.

Abstract:

IL-1α is a master regulator of inflammation. Neutralization of IL-1α has shown promising results in clinical trials for several diseases, but has never been tested in IBD. The blockade of IL-1α in our mouse model of chronic ileitis showed amelioration of the diseases suggesting a new treatment approach in patients with CD.
Abstract

Background: Patients with multiple sclerosis (MS) seek MS care at healthcare facilities according to their individual circumstances. The relationship between healthcare seeking behaviors and clinical expression of MS in affected individuals is unclear.

Objectives: To investigate the relationships between type of care patients receive and their health-related quality of life (HRQOL), disease activity, global disability, and hospitalization.

Methods: This is an investigation of 993 white individuals with MS, who completed the Spring 2014 update survey. The appropriate regression models (linear, logistic, and generalized logistic models dependent on the distribution of the outcome) were used and adjusted for potential confounders including gender, race, body mass index, smoking status, medication history, disease duration, disease type, onset age, and age at interview. Stratification for disease subtype was also performed.

Results: Study participants sought medical care with professionals at specialty clinics or private neurologists (86.0%), general practitioners or other care (7.6%), and no care (5.2%). Compared to those seeking care with a professional, patients not seeking any care had significantly greater HRQOL physical component scores (PCS) (p=0.002) and lower global disability (p=0.02). Patients who sought no care suffering from a progressive form of MS had worse HRQOL mental component scores (MCS) (p = 0.007) and were 3.5x more likely to have a MCS below the US population average compared to those seeking care with a professional.

Conclusion: Patients seeking care with non-MS professionals did not have major differences in health outcomes compared to patients seeking care with MS professionals. MS patients who do not seek care may have less physical impairment compared to other patients. Surprisingly, non-care seekers with progressive disease have worse mental health, despite less disability than MS patients actively seeking care.
Abstract

Magnetocaloric materials have gained interest as a way of replacing the standard vapor-compression with a more efficient method that does not require hydro-chlorofluorocarbon refrigerants. However, designing a material with the ideal Curie temperature and refrigeration capacity has proven difficult. An ideal magnetic refrigerant has a high change in magnetic entropy near room temperature. Since the peak magnetic entropy change occurs around the Curie temperature of the material. One group of materials that has potential to achieve the appropriate Curie temperatures while being able to achieve high peak magnetic entropy changes is amorphous iron-based alloys. However, they have still been difficult to optimize. That is why this project is working on creating a mathematical model that describes how the composition of the material affects its Curie temperature and its peak magnetic entropy. The goal is to be able to determine which compositions need to be tested computationally and drastically reduce the amount of guess work and trial and error needed to discover optimal materials. This is being done by using data gathered about these properties and using it to create univariate and multivariate regression models of how the properties change as composition changes. From these models, new compositions that may have not been tested before but have potential to be good magnetic refrigerants will be tested while time is not wasted on compositions that are not optimal in either or both properties. This presentation will describe the modeling techniques used to optimize the magnetocaloric properties of amorphous-iron based alloys.
Brain-heart interaction is well recognized; however, Acute coronary syndrome (ACS) due to brain pathology is uncommon. Here we describe a case of this caliber. A 75 years old African American lady, who has a very significant past medical history of coronary artery disease (CAD) requiring coronary artery bypass graft (CABG) and multiple percutaneous coronary interventions (PCIs), was admitted to University Hospitals Richmond Medical Center for severe progressive headaches in the setting of hypertensive emergency. She did not have any cardiac symptoms at the time, her ECG was benign, and her troponin was 0.04. A non-contrast head CT showed no acute changes. The next day, while she was inpatient, she suffered a tonic-clonic seizure that lasted for 5 minutes. An ECG obtained 30 minutes after her seizure had shown inferior was ST-elevations. She was loaded with Aspirin and Ticagrelor, started on Heparin drip, and transferred to University Hospitals Cleveland Medical Center for primary PCI. Her coronary angiography showed an 80% stenosis in the middle of her right coronary artery (RCA), with a TIMI flow 3 pre-intervention. Optical coherence tomography (OCT) revealed no thrombus or plaque rupture. She received a drug-eluting stent (DES) of her mid-RCA stenotic lesion, with good flow post-intervention. Transthoracic echo on day-3 post STEMI was notable for inferolateral walls hypokinesis. Neurology consult team had the impression of posterior reversible encephalopathy syndrome (PRES) secondary to malignant hypertension, which explains the seizure. This case shows the importance of brain-heart interaction. The patient did not have a thrombus or plaque rupture, and yet, she suffered from an STEMI. This can be explained by a complete RCA vasospasm from a catecholamine storm post-seizure, that resulted in an STEMI picture. Therefore, this illustrates the importance of ECGs in patients with acute brain pathologies and consideration of ACS in this population.
In the IEA PVPS report “Review of Failures of Photovoltaic Modules”, it is stated that automated feature detection from electroluminescent (EL) images has yet to be successfully established. Our group acquired a data set of 90 total 60-cell module images from 5 commercial brands over 6 exposure steps of damp heat testing. Automated algorithms were developed using the open source coding language Python to parse the module images into individual cell images. As the original images are not directly suitable for modeling, this algorithm implements techniques which include filtering, thresholding, convex Hull, regression fitting, and perspective transformation to pre-process the original image. After cell extraction, 5400 individual cell images were obtained. From the data set, 3 main degradation categories were observed: good, cracked, and heavily busbar-corroded. For supervised machine learning classification, these images were manually sorted into these 3 categories. To increase the data set size, the cell images were augmented by flipping the images about the x-axis and y-axis as well as rotated 180 degrees. This increased the total sample size to 14,200 images with good, cracked, and heavily corroded counts of 12,004, 492, and 1704, respectively. A supervised training set was generated from 15% of sorted “good” cells and 80% of the sorted “cracked” and “corroded” cells. The statistical learning models, Support Vector Machine (SVM), Random Forest (RF), and Artificial Neural Network (ANN), were independently trained on the training set and then given the remaining data images to predict their classification. The results showed model prediction accuracies of 98.77%, 96.60%, and 98.13% for the SVM, RF, and ANN models, respectively.
Abstract

As wind energy penetration increases, the grid operators need more optimized power control capabilities of the wind farms. The current approach used by the wind turbine manufacturers deals with fixed active power reference look-up tables to help the grid operator controlling the frequency. However, this approach is fixed and does not consider power generation efficiency or mechanical fatigue issues. To address these problems, we develop a new cooperative control strategy that provides power generation optimization. The new methodology relies on finding the optimum rotational velocity of the wind turbines of the wind farm such that the sensitivity of power generation to the change in the wind velocity is minimized. The new strategy is validated by using NREL FAST simulation and graphing results are presented.
Research Thrusts of the Tissue Fabrication & Mechanobiology Lab

Research thrusts in the Tissue Fabrication and Mechanobiology Lab include tendon tissue engineering using woven collagen biotextiles, 3D printing of ear scaffolds, cartilage tissue engineering using macroporous collagen scaffolds, and pure collagen sutures for growth factor delivery in tendon laceration repair. These projects aim to improve treatment of musculoskeletal injuries.

**Abstract**

3D Stereolithographic Printing of Human Ear Tissue Engineering Scaffold

Ear-shaped hybrid scaffolds were fabricated by stereolithography using various resin formulations in a Formlabs 3D printer. The shape of ears were extracted from MRI data and converted to 3D-printable format. A hybrid biocompatible resin was formulated using chitosan and polyethylene glycol diacrylate (natural and synthetic polymers, respectively). 3D-printed scaffolds were lyophilized prior to SEM imaging. Hybrid scaffolds exhibited interconnected pore structure. Scaffolds exhibited robust mechanical properties. Cell viability and cell spreading was observed via actin filament staining and histological examination.

Tendon Tissue Engineering with Woven Collagen Biotextiles

Tendon injuries heal poorly, and surgical repair using sutures often fails, especially for rotator cuff tendons. Being able to replace missing/defective tendon tissue would benefit repair outcomes. Biomimetic woven collagen scaffolds were explored for rotator cuff tendon regeneration in an in vivo rabbit model. Addition of mesenchymal stem cells to woven collagen scaffolds enhanced repair stiffness and strength after 3 months in vivo. Woven scaffolds were not a detriment to strength or stiffness of repairs. Addition of stem cells enhanced midsubstance failures beyond scaffold repair alone, suggesting improved integration between soft and hard tissue. Micro-CT revealed moderate fatty infiltration in direct repair muscles, whereas only mild fatty infiltration was noted in scaffold repair muscles. Overall, this study presents a novel approach which may hold merit for tendon repair and regeneration, and findings support the use of woven collagen biotextiles, possibly combined with patient-derived mesenchymal stem cells, for repair of rotator cuff tendon defects.
Purpose: This poster will highlight findings from the 2015 Cleveland Behavioral Risk Factor Surveillance Survey (BRFSS), a representative, phone-based survey of Cleveland adults. The survey captures various health indicators, such as chronic diseases (diabetes, hypertension, asthma), substance use, diet & exercise, quality of life, and access to healthcare.

Methods: The 2015 BRFSS was administered to 2,522 adults over the age of 18 in Cleveland, Ohio. Participant answers were weighted to represent the population of all adults in the city of Cleveland. The local BRFSS was also conducted annually between 2005-2009 providing trend data. State and national comparisons are made using the national BRFSS conducted by the CDC. All data analyses were conducted using weighted functions of SAS/SPSS Statistical software.

Results: In 2015, Cleveland adults with health care coverage reached an all-time high at 87.0%. Prevalence of diabetes (14.6%), asthma (14.8%), and tobacco use (39.2%) increased over the past decade. Even though over half of Cleveland residents have household incomes < $25,000, nearly 90% of Cleveland residents are hopeful for the future of their family and >80% are hopeful for the future of Cleveland. We also see a decrease in those who've had at least 1 drink in the past 30 days (45.1%) compared to previous years. Although 61.4% of Cleveland residents participated in any physical activity in the past 30 days, 62.2% of Clevelanders did not meet aerobic recommendations.

Discussion: During the survey period, 2005-2015, we see increased prevalence in Cleveland residents who report access to healthcare, have 1 or more personal doctors, and are hopeful for the future of their family and of Cleveland. However, chronic disease indicators, tobacco use, and rating health as fair or poor has increased over the last ten years. Local surveillance is an important aspect of research aiding in planning, implementation, and evaluation of our programmatic efforts in Cleveland.
**Title**: X-Ray Hydroxyl Radical Protein Footprinting of Intact, Functional Mitochondria

We have developed methods to interrogate proteins within isolated mitochondria in order to compare the structure and function of mitochondrial proteins in situ in different disease or metabolic states. This approach to probe the structure of proteins directly in isolated mitochondria preserves native interactions and may reveal novel mechanisms of cell based protein structure.

**Key Words**: Structural biology, Mitochondria, X-ray footprinting, Mass spectrometry

**Abstract**

X-ray mediated hydroxyl radical protein footprinting (XRF) coupled to mass spectrometry (MS) is a well-characterized method for investigating the structure of proteins in vitro. Exposure of aqueous biological samples to X-rays generates hydroxyl radicals that covalently react with protein side chains to form oxidized products, which can be detected and quantified using MS to provide a measurement of the solvent accessibility of amino acid residues. We have developed methods to interrogate proteins within isolated mitochondria in order to compare the structure and function of mitochondrial proteins in situ in different disease or metabolic states. This approach to probe the structure of proteins directly in isolated mitochondria preserves native interactions and may reveal novel mechanisms of cell based protein structure.

Our XRF method has been validated by four experiments conducted on two different beamlines: 5.3.1 at ALS at Lawrence Berkeley National Laboratory and 17-BM at NSLSII at Brookhaven National Laboratory. Overall, 1201-1504 proteins were identified, and of those 65-233 proteins were covalently modified by radiolytic hydroxyl radicals based on results obtained from database searches performed using Mascot and Scaffold. ATP synthase subunit beta, heat shock protein 60, complement C1q binding protein, and cytochrome c oxidase subunit 2 were selected for manual validation due to their high abundance in the sample and/or relatively large number of oxidative products. Reproducibility in calculated reactivity rates for oxidized residues of proteins of interest were found in multiple experiments.
In the pursuit of constructing “living machines” - robotics whose control, actuation, and structure are all comprised of organic materials - it is critical to consider the most effective methods of inducing locomotion. Many synthetic scaffolds offer a strong foundation for biohybrid robotics but often require additional treatments to promote cellular adhesion and induce cellular alignment. Here we present a manufacturing process and culture conditions for fabrication of living machines using electrochemically compacted and aligned collagen (ELAC) as a scaffold. ELAC scaffolds are then seeded with primary cardiomyocytes isolated from chick embryos and electrically stimulated to induce movement. We then present the Aplysia californica as a novel source of biologic material and explore its potential as both an actuator and scaffold. Ultimately, this work will serve as the foundation of a fully organic living machine capable of navigating a local environment.
The Patient Hand Cleaning System will be placed at the bedside of each hospital patient to promote patient hand hygiene while removing the burden of this from the healthcare workers. Before the implementation of this device, nurses would have to monitor each of their patients to ensure that hand hygiene is being met. Having many patients, this gives the nurses a tremendous amount of extra work. The automated Patient Hand Cleaning System will relieve nurses of this extra load by alerting patients to clean their hands before meals.

Upon hearing the alert, patients simply have to move their hands to their bedside and place them in the device. This movement requires limited physical activity, so most patients will be able to perform this action on their own. When the device senses the hand(s) in place, it will dispense approximately 5 mL of an alcohol-based sanitizer and encourage the user to spread the sanitizer over their whole hand(s). The system will be able to hold 40 mL of sanitizer, so it will need to be replenished every three days. The device will be lightweight and small so as not to be in the way of patients and healthcare workers. Furthermore, the device will collect data on the user and frequency of use through the barcodes on hospital bands. Hospitals will have the opportunity to study the collected data and even use the data to protect themselves from lawsuits.
**Title**: Symptom Burden, Quality of Life and Care Planning

**Abstract**

Introduction: Chronic Obstructive Pulmonary Disease (COPD) is a chronic lung disease with a long disease trajectory and one of the highest readmission rates in the United States. According to the World Health Organization, COPD is the 3rd leading cause of death by 2030 that currently contributes almost $50 billion in health care expenditures. However, the highest consequence of COPD for both the patients and their families, is the symptom distress and unknown future. As symptom distress increases and quality of life inversely decreases, medical care becomes primarily focused on symptom control which commonly results in unwanted medical therapies including mechanical ventilation. Without an advance care plan, patient outcomes may not be focused on their individual desires, and families face the grueling task of decision-making.

Methods: The proposed research is a mixed methods design based on the Theory of Unpleasant Symptoms by Lenz. The goal is to explain the concepts of symptom burden, quality of life and the potential influence on care planning.

Conclusion: An extensive literature review proves that there is not enough research in the care planning arena for the COPD population. Through description of this relationship, we can potentially change care to include patient care outcomes that are focused on quality of life, not quantity of hospital stay days.
Active floating platforms are a potential solution for offshore wind turbines in deep waters. This project deals with the design, construction, experimentation and control of a lab-scale offshore wind turbine with a Tension Leg Platform (TLP). The design is based on a 3-blade rotor wind turbine with a DC electrical generator and a full power converter, a Stewart Platform able to simulate the ocean waves and a new mechanism to emulate the TLP active control system. The experiments are conducted at the Control & Energy Systems Center Wind Tunnel, at CWRU. The effects of (1) the movements of the platform due to the wind and ocean waves, and (2) the damping provided by the active control system are studied experimentally and optimized using multivariable QFT robust control strategies.
The neonatal portable oxygen blender is a device used to deliver specific concentrations of oxygen to neonatal patents via nasal cannula. This reduces free radicals in the air making it safer for neonatal patients. The device must satisfy three main goals: (1) Well blended air/oxygen output (2) Flow rate control (3) Variable output oxygen concentration. Our first prototype was a capacitative blender composed of fans, valves, flowmeter and an oxygen bottle. The capacitative blender uses principles of transport phenomena in order to create turbulent flow to evenly mix the oxygen and air. A fan introduces air into the system diluting the pure oxygen input. A commercially available valve regulates the rate of flow out of the blender. Additionally a 3 way junction with 2 way valve controls the output oxygen concentration by varying the ratio of oxygen to air. We learned that our device is functional with the use of commercially-off the shelf (COTS) parts thus allowing for our device to be low cost and accessible. Additionally our prototype is a system integration task/problem where the removal of air tanks resulted in the backflow that accounted for most, if not all, the verification failures. Our future plans include utilizing a venturi effect product as our main blending source with additional valves to resolve backflow.
The Effect of Preoperative Buprenorphine Nerve Block on Endodontic Postoperative Pain of the “Hot tooth”: A Prospective, Randomized, Double-blind, Control Trial

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Many patients today are unable to consume NSAIDS due to numerous health conditions such as gastrointestinal complications, asthma or drug interactions. This could leave them with acetaminophen or narcotics for severe pain control. The addition of 0.3 mg buprenorphine to bupivacaine [34] or lidocaine [35] had a significant effect on postoperative analgesia in minor oral surgery procedures when used with inferior alveolar nerve blocks and local infiltration. The purpose of this study was to inves...
The T-type thermal probe which is an extension of the the 3 method is a popular technique used to measure the thermal conductivity of 1D nanomaterials, such as carbon nanotubes and nanofibres. In this method, a sub-micron diameter platinum wire is heated electrically, acting as both a probe and a heater. Suspending a free standing 1D sample at the center of the wire results in a drop of the average temperature of the heater wire, which in turn is reflected as a change in its electrical resistance, which is recorded to estimate thermal conductivity of the 1D sample. It is a good technique for 1D nanomaterials, owing to the narrow point of contact made between the probe and the sample. This method, however, cannot be used for 2D nanomaterials, due to the line contact made by the sample with the probe wire, resulting in a spatially non-uniform heating of the sample along the line of contact, leading to inaccuracy in measurements.

In this research, we present the development of a new experimental method to measure the thermal conductivity of 2D nanomaterials, by designing a MEMS based sensor device. The sensor is developed by patterning the platinum wire probe with a larger cross sectional area at its center, which reduces the electrical resistance and in turn the Joule heating in the middle section. This results in a relatively uniform temperature profile along the entire contact length of the probe wire and the 2D sample, which leads to an improved accuracy in the thermal conductivity measurement in 2D nanomaterials.

Our method is general enough to also allow high fidelity thermal conductivity measurements in 1D nanomaterials. The device can be used for characterization of both in-plane and out-of-plane thermal conductivity measurements in 3D hybrid nanostructures. The validation of the new method and the working of the device is established by presenting thermal conductivity measurement results for suspended single layer 2D graphene.
After surgery, many patients exhibit complications as a result of stressful experiences in the Intensive Care Unit (ICU). In order to limit these complications, we have designed an ICU Stress Measurement System to monitor patient stress levels during recovery using physiological signals associated with autonomic nervous system activity, which controls the body’s physical response to stress. Reducing stress levels in ICU patients can improve physical and emotional recovery by achieving and maintaining homeostasis within the body. The ICU Stress Measurement System extracts variables from electroencephalogram and electrocardiogram readings and passes them into a combinatory algorithm that quantifies patient stress in the form of a ‘stress index.’ Our device provides a novel method of determining the physiological manifestation of stress, which can be used by clinicians to reduce patient stress and improve conditions for ICU recovery.
EBPs are interventions intended to effectively treat people with various psychological disorders. Each EBP contains a variety of treatment criteria. Implementation of a complete EBP is resource-intensive. With knowledge of the most important treatment criteria, providers could focus resources on implementing a smaller number of effective treatment criteria. Many providers of ACT also provide IDDT since consumers with severe psychological disorders also experience substance use disorders. Currently, fidelity to ACT and IDDT is assessed separately. One unified assessment would be more efficacious. The critical ingredients of IDDT could be added to a fidelity scale for ACT to create one assessment. For our project, we plan to determine the critical ingredients of IDDT.

To find the critical ingredients of IDDT, we first studied two critical ingredient articles for ACT. The studies determined the critical elements of ACT through a literature review and the Delphi Model. Through the Delphi Model, experts complete a survey on their field of expertise. We then reviewed other studies that followed the Delphi Model, and decided our study will involve two rounds of the model and include a panel of experts in the IDDT field. Phase 1 involved a targeted review of the literature to identify the support for the treatment criteria of IDDT. From this we will form a list of potential critical ingredients. The preliminary list will be sent to identified experts. Members of the expert panel will rank the importance of each criterion on a Likert scale. The experts will be able to list any other essential criteria not identified. A revised list of criteria will be sent through a second round. The results of the final round will determine the critical elements of IDDT. These results will be compared to the findings from the literature review. Knowledge of the critical ingredients of IDDT would allow for realistic implementation of an empirically and theoretically supported treatment.
Raman spectroscopy (RS) is a fundamental tool used in materials science, biology, energy, medicine, chemistry and physics. Embedded in the Raman spectrum is the information on the identities and amounts of chemical species, the conformation of the bonds (such as crystallinity/purity) and molecular morphology (alignment of groups). CARAM is equipped with four specialty Raman systems that uses green, NIR and IR lasers. Systems are accessible as a service center.
In 2016, there were 212 million cases of malaria, resulting in 429,000 deaths. Anti-malarial drugs and vector control have substantially reduced the burden of disease. From 2010 – 2015, the incidence of malaria dropped 21% and related deaths also dropped 29%. While progress is being made in disease reduction, there is an emerging issue of decreased immunity due to lack of exposure. Malaria is a disease affecting mainly children, as adults have naturally acquired immunity against the clinical stage of the disease. Clinically, immune individuals can still transmit malaria, thereby continuing the spread of infection to non-immune individuals. In areas of low exposure, there have been several cases of malaria resurgence, a threat especially dangerous to those who have lost their immunity. Some individuals maintain immunity for notably longer periods, a phenomenon immunologists are working to characterize in an effort to learn the mechanisms of immunity and build upon in creating a vaccine. There are numerous biological markers at the cellular and molecular level that can indicate sustained immune memory. The present study aims to characterize antibody responses and longevity, as well as ascertain any associations with disease protection as a way of assessing immune memory.

In Papua New Guinea in 2015, 200 individuals were followed during acute clinical infection with malaria, and also throughout the convalescent stage. Blood samples were collected at three time points: the acute stage, 7-10 days later, and 1-6 months later. Serum samples are currently being tested for the relative amounts of antibodies to a panel of 28 malaria-specific antigens, total IgG, total IgG1 and 3, and malaria-specific IgG1 and 3. Antibody levels will be compared to clinical symptoms and parasite burden to look for correlates of protection. Additional analysis will be done on antibody half-life lengths to look for associations between antibody longevity and immune memory.
Fouling on surfaces of heat exchangers, typically made from AISI-316L stainless steel, is a challenging problem in many industrial applications. Fouling can result in high cost and even safety issues. It is known that AISI-316L is prone to fouling due to its high surface energy (SE) and hydrophilic nature. Controlling surface properties by surface engineering can be an effective way to reduce fouling. In this pilot study, therefore, we studied the efficacy of a novel method of surface engineering for this purpose: low-temperature carburization (LTC), which was applied on the AISI-316L coupons. The SFE of surface-engineered specimen and non-treated references was obtained by measuring contact angles of droplets of both polar (H2O) and dispersive (CH2I2) liquids, from which the SE is obtained by applying the Owen and Wendt equation. The correlation between surface roughness and contact angles was further explored by grinding the sample surface with different sandpapers. The experimental results show an increase of contact angles of LTC-engineered AISI-316L. The average contact angle between H2O increases from 19.6° to 82.8° while that between CH2I2 increases from 45.2° to 59.6°, corresponding to a transformation from hydrophilicity to hydrophobicity. The surface energy of carburized 316L stainless steel was reduced to around 45% of the SFE of the untreated sample. The correlation between the surface roughness (Ra) of untreated 316L and contact angles was found to be positive, indicating that the wetting properties of the AISI-316L stainless steel are proportional to the roughness of the surface wetted. This result reveals that changing surface roughness necessarily involves a proportional change in the wetting characteristics of the solid by increasing the intensity of surface energy. Presumably owing to the complexity of surface morphology, the reproducibility of the contact angles of treated/untreated AISI-316L was not perfect.
IL-17C is highly expressed in psoriasis skin and is thought to promote inflammation by binding IL-17RA and IL-17RE. Keratinocyte-overexpressing IL-17C (IL-17C+) mice develop a psoriasiform skin phenotype. To investigate IL-17C-mediated inflammation, IL-17C+ mice were mated with IL-17RE-deficient (KO) mice and skin examined. IL-17C+IL-17REKO mice had similar acanthosis and T cell numbers as IL-17C+ mice (n=8/grp; P>0.1), as did IL-17C+ mice transplanted with bone marrow from CD4-IL-17RE vs. WT mice (n=6-9; P>0.1). These results suggest that IL-17C signaling is IL-17RE independent. Next, IL-17C+IL-17REKO mice were treated with anti-IL-17RA antibodies and a 54% reduction in acanthosis was observed (n=3; P=0.006), suggesting that IL-17C-IL-17RA signaling is critical for skin inflammation. In KC-Tie2 psoriasis mice, skin IL-17A and IL-17C increase ~15-fold (P<0.05) and anti-IL-17A and anti-IL-17RA antibody treatment improves acanthosis and decreases CD4+ T cells (P<0.05 vs. IgG, n=5-11/grp), with anti-IL-17RA having greater efficacy than anti-IL-17A (P=0.02). This suggests that both IL-17C and IL-17A signaling through IL-17RA are critical. Indeed, genetic deletion of IL-17C from KC-Tie2 mice led to a 67% and 58% decrease in acanthosis and CD4+ T cells, respectively (n=8/grp; P<0.001 vs. KC-Tie2 mice). Finally, IL-17A modulation in IL-17C+ mice using anti-IL-17A antibodies, transplanting IL-17AKO bone marrow or introducing intradermal IL-17A, each had no effect on IL-17C+ skin inflammation. Our results demonstrate that IL-17C-mediated skin inflammation occurs in an IL-17RE independent, IL-17RA dependent manner and that a tiered balance between IL-17C-IL-17A-IL-17RA signaling may dictate levels of inflammation.
A novel approach to fabricating and testing artificial insect wings has been developed. Utilizing these new techniques, locally harvested hawk moth (Manduca sexta) forewings are compared to engineered forewings with varying wing structures. A number of small, flexible engineered forewings were fabricated with identical planform size and shape but with a range of camber, ribbing, thickness and composition. A series of static and dynamic assessments compares the forewings in terms of structure and performance. Data from these experiments show that the fabrication method can produce artificial forewings with similar properties to that of Manduca sexta. Flexural stiffness (EI) data shows a maximum percent difference of 41% between left and right natural M. sexta forewings, whereas engineered forewings have a maximum percent difference of 18%. When deflection is induced from the ventral side of the forewing, EI values are at least 9.1% higher than when it is induced from the dorsal side. According to simulations, approximately 5.2% of this difference can be attributed to the camber of the forewings. Fabricated forewings produced comparable amounts of lift to natural M. sexta forewings (1.00 gram-force and 0.96 gram-force at 25 Hz flapping frequency respectively).
Abstract

Effective navigation in the real environment requires multi-dimensional locomotion. Adding steering to a soft-bodied earthworm like robot permits more precise control and allows for experiments in more complex environments. Here, our objective is to show how a dynamical controller coordinates the many compliant degrees of freedom of a soft-bodied robot to locomote in two-dimensions. We demonstrate how body softness affects straight motion and turning for the controlled coordination of worm-like segments. Our new soft robot, compliant modular mesh worm robot with steering allows us to characterize these properties. The 3D printed mesh allows us interchange components easily to vary the stiffness of the robot. Experiments were conducted to test the performance of the robot using a stable heteroclinic channel (SHC) controller. SHC controllers allows predictable noise-driven variability of the robot’s locomotion pattern to control the actuators. Robot speed and turning angle is calculated with different stiffness properties. These analyses helps us understand and define stiffness parameters required for efficient locomotion in two dimensions, which will be useful for the design and control of future peristaltic devices.
Intro: While MRI is sensitive at detecting high-grade cancer lesions, low-grade lesions are more difficult to classify. Currently, the result of trans-rectal ultrasound guided prostate biopsy is considered the standard of care for disease diagnosis but is inherently deficient based on the standard 12-core biopsy sampling method. In this study, we compared the ability of MRI to detect disease in comparison to biopsy of the prostate.

Methods: 319 MRI’s of prostates were analyzed and the results were compared to a biopsy that was performed within 180 days of the MRI. MRI reports were compared to biopsy results using two methods: Method 1) overall ability to detect disease on MRI (PIRADS > 3) using biopsy results as a reference; and method 2) comparison of MRI versus biopsy with McNemar’s test to determine if one diagnostic method is more accurate than the other.

Results: The median Gleason score of the biopsies was 3+3, and median PIRADS score of the MRI was 4. The sensitivity of method 1 analysis is excellent at 89.72% (± 3.94), which is similar to the ranges reported by other groups, and the specificity was 47.69% (± 12.61), indicating there is a discrepancy at ruling in disease between the two tests. In method 2, McNemar’s chi-squared test shows that there was no statistical significance in the sensitivity of MRI versus biopsy (p=0.37) with a value of 0.82. Kappa’s test for agreement returned a value of 0.392, which is considered to be fair agreement.

Conclusion: This study validates that MRI can detect if disease exists in patients with prostate cancer compared to biopsy. In method 2, we observe that neither MRI or biopsy are significantly more accurate. However, there is an added benefit of performing MRI exams because it is detecting lesions that biopsy would generally not detect and vice-versa. The analyses made were based on the biopsy as the gold standard, but the two diagnostic tests are performed in vastly different manners and offer unique information.
Comparison of PV Module Backsheet Materials Under Multi-Factor Accelerated UV Light Exposures

Abstract

Long term outdoor durability of photovoltaic module backsheets is critical to the module’s power output over lifetime. The use of fluoropolymer-based backsheets or the addition of stabilizers to polyethylene-terephthalate (PET) and polyamide (PA) type backsheets can help extend the lifetime of these backsheets. In this study, the performance of 23 different types of backsheets under ASTM G154 Cycle 4 accelerated light exposures are presented. The backsheets were subjected to 4000 hours of high irradiance UVA light at 1.55 W/m²/nm at 340 nm at 70 degrees C with or without condensing humidity cycle. Backsheets were evaluated, with repeated measurements, using various evaluation techniques to identify and assess potential degradation mechanisms. These evaluations included the change in yellowness index (YI), gloss, UV-Vis absorbance, and Fourier Infrared (FTIR) spectroscopy. Fluoropolymer-based backsheets were found to withstand these exposure with only slight changes; however, PET and PA based backsheets showed serious yellowing and cracking under indoor exposures, and the stabilizer additives only helped protecting the polymers to some extent. Semi-supervised, generalized, network structural equation modeling (netSEM) analytics was then applied in order to explore statistically significant relationships describing the degradation of materials. In this stress | mechanism | response (<S|M|R>) framework, the type and level of multiple stressors (UV light, heat, humidity) and the observed physical and chemical responses are connected with statistical models to discover a network of mechanistic degradation pathways identifying factors contributing to overall degradation.
Objective: This study evaluated the wear of CAD/CAM milling diamond burs and the effect on surface morphology of ceramic restorations. Methods: Three pairs of Sirona diamond burs (cylinder pointed and step burs) were divided into three groups according to the number of millings performed: control group (G1) fifteen millings; (G2) twenty-five millings; and (G3) thirty-five millings. Seventy-five pre-molar typodont plastic teeth received a full crown preparation. Scanning of the preparation and crown design were performed using the Cerec Optispray and Cerec BluecamAC acquisition unit running the Cerec 4.4 software. The Vita-Mark II ceramic blocks were milled by means of a Cerec Compact milling unit. For the quantitative and qualitative analyses, crowns and burs were submitted to confocal laser microscopy. Additionally, burs were submitted to SEM analysis for wear and surface damage evaluation. Data from the confocal laser microscopy were analyzed by ANOVA, Kruskal-Wallis, Tukey’s, and paired t-test (p<0.05). Results: SEM analysis showed diamond particle damage and wear on both cylinder and step burs. However, no major defects generated by pulled-out particles were found in G1 and G2. In G3, the cylinder bur ended up chipping at milling #34 and signs of surface damage, cracks and particle losses were found. For the morphological alterations, ANOVA indicated that burs from G1, G2 and G3 had similar roughness without statistical difference (p>0.05). Crowns milled in group G3 showed higher values of roughness (p<0.05) when compared to G1 and G2. Conclusion: Different numbers of millings affected the overall restoration surface roughness, although still in the range of clinical acceptance levels. It also affected the wear and chipping factor on the burs.
Finding genes with elevated rare variant burden in myeloid malignancy patients

Myeloid malignancy is a rare but severe clonal disorders found in hematopoietic stem or progenitor cells. Both genetic and epigenetic changes can contribute to the disease by disturbing some key aspects in cells such as self-renewal, proliferation and differentiation. Myeloid malignancy includes both acute myeloid leukemia (AML) and myelodysplastic syndromes (MDS). Therefore, it is important to know genes are associated with myeloid malignancy in order to increase our understanding assess disease risk and develop therapeutic strategies to treat the disease. One of the risk factors in myeloid malignancy is mutation in some genes, such as AML1, IDH1/2 and TET2, are known to be associated with an increased risk of the development of myeloid malignancy. However, there are still a big question of whether germline rare variants have any contribution to myeloid malignancy or not. We hypothesis that germline rare variants are important in myeloid malignancy and genes which have increased germline rare variants burden will more likely to contribute to disease phenotype.

Key Words
- Rare variant
- Myelodysplastic syndromes
- Germline
- Acute myeloid leukemia

Abstract
Myeloid malignancy is a rare but severe clonal disorders found in hematopoietic stem or progenitor cells. Both genetic and epigenetic changes can contribute to the disease by disturbing some key aspects in cells such as self-renewal, proliferation and differentiation. Myeloid malignancy includes both acute myeloid leukemia (AML) and myelodysplastic syndromes (MDS). Therefore, it is important to know genes are associated with myeloid malignancy in order to increase our understanding assess disease risk and develop therapeutic strategies to treat the disease. One of the risk factors in myeloid malignancy is mutation in some genes, such as AML1, IDH1/2 and TET2, are known to be associated with an increased risk of the development of myeloid malignancy. However, there are still a big question of whether germline rare variants have any contribution to myeloid malignancy or not. Therefore, one possible explanation is that rare variants may play a role in contributing myeloid malignancy. Because of the advancement of sequencing technologies, we now can compare the sequencing data from patients and an independent set of samples and search for germline rare variants. We hypothesis that germline rare variants are important in myeloid malignancy and genes which have increased germline rare variants burden will more likely to contribute to disease phenotype.
Anopheles mosquitoes are the primary vectors of the high-morbidity and often neglected Plasmodium species, P. vivax. Learning as much as we can about these mosquitoes is vital to the ultimate goal of malaria elimination. This study characterizes 178 mosquitos collected in November of 2015 in the southwestern region of Madagascar, an area facing an epidemic of malaria at that time. We utilized PCR methods to diagnose mosquito species, host species, and determine malaria infection status. We found two Anopheline species: A. arabiensis and A. funestus. Overall malaria infection status of the mosquitos was 10%, with A. funestus showing a significantly higher propensity for both human feeding and malaria infection.
Strategic modifications to an existing single stage gas-gun at Case Western Reserve University allow the use of a novel approach for conducting high temperature normal and/or combined pressure-shear plate impact experiments for investigating dynamic material behavior under extreme conditions (i.e. ultra-high strain-rates >10^6/s and test temperatures up to 1000°C). To enable this approach, a custom designed extension piece allows for the incorporation of a resistance heater with axial and rotational degrees of freedom to the breech-end of the gas-gun, and a new heat-resistant sabot design enables thin metal specimens held at the front of the sabot to be heated reliably (via free-radiation) to temperatures in excess of 1000°C without the risk of seizure of the sabot within the gun-barrel. Using these newly developed capabilities, backwards-geometry normal plate impact experiments are performed at a range of temperatures in order to investigate the dynamic behavior of aluminum at the onset of plasticity in response to weak normal shock compression. The results from these experiments show a net increase in the dynamic strength of aluminum at near melt temperatures, and can be attributed to the transition in plastic flow mechanisms from thermal activation to (viscous) phonon drag.
Abstract

With the rising amount of renewable energy sources being introduced in the electrical grid there is an interest in determining how the grid will be impacted. Specifically, the grid has largely been impacted by the lack of inertia in renewable sources of power generation. Typically, the grid frequency is stabilized by the inertia of the generator, but the renewable energy sources are interfaced with power electronics that diminish the amount of inertia in the grid. This project focuses on ways to use wind energy systems to stabilize the grid frequency.
The purpose of this facility is to produce nano-crystalline soft magnetic alloys using rapid solidification by the single-roller melt spinning technique. This technique produces amorphous alloy ribbons approximately 25 micrometers thick and 2.5 millimeter wide using quenching rates exceeding $10^5$ Kelvin/second. This facility allows control over the speed of the quench wheel, the temperature of the melt, the crucible, crucible ejection pressure, and the atmospheric conditions in addition to processing a sample size up to 200 grams. These parameters affect the magnetic properties of the resulting alloy ribbon, including but not limited to saturation magnetization, magnetostriction, and coercivity. The processing of nanocrystalline soft magnetic alloys has enabled smaller, lighter, and more efficient materials used for energy storage, conversion, filtering, power generation, and sensing.
Metal Matrix Composite (MMC) materials have potential to be used in applications requiring light weight and high stiffness. A range of Discontinuously Reinforced Aluminum (DRA) composites were produced and tested under uniaxial tension. Samples of 2xxx and 6xxx series aluminum alloys, reinforced by silicon carbide (SiC) particles between 17% vol. to 40% vol., were observed to have values for elastic modulus, yield strength, and ultimate tensile strength on the order of 100 GPa, 450 MPa, and 560 MPa respectively. Variations in mechanical properties of identically processed samples were attributed to the distribution and density of reinforcing SiC particles within the matrix. SEM investigation of select samples further investigated trends in mechanical behavior based upon observable microstructural features.
Abstract

The use of peripheral venous catheters is very common in hospital patients where about one in three patients have the catheter inserted at any time [1]. Inflammation and infection are a cause for concern in these catheters and because so many people use them, there is a high demand for their optimization. It has been estimated that over 250,000 catheter related bloodstream infections occur every year [2]. In order to decrease complications, our group focused on reducing hemorrhage, infiltration, and infection by improving the procedure of IV insertion through the optimization of penetrative angle and guidance of the IV into the insertion site. Infiltration could be prevented by improving insertion of the IV so that the needle does not puncture through the vein. An IV insertion guide can be created to ensure that new nurses and those in training are able to measure the angle of the needle while starting a peripheral IV. The guide will be able to be strapped to the patient’s arm or hand and have a guide window which will be aligned with the vein. A free moving arm will rest upon the casing of the IV allowing the user to see the angle on an attached protractor. This permits the user to ensure that the angle of insertion is appropriate according to standard guidelines as well as identify the angle as the IV is lowered towards the skin.

Abstract

The Affordable Care Act (ACA) has made it possible for millions of Americans to become insured. Usage studies show that consumers are not following through with utilizing the benefits of their insurance. The lack of use is seen especially in the realm of preventative care. Insurance literacy is found to be related to consumers’ confidence in insurance decision making and varies substantially across racial and ethnic groups. Increasing consumers’ health insurance literacy could have the potential to increase utilization of preventative care by allowing patients to better understand the services afforded to them and how to access these services. The intent of this pilot study is to build a model for an evidenced based health insurance literacy program for newly insured health insurance consumers which utilizes storytelling as a means of relaying information in a culturally competent method. A mixed methods study was conducted to understand barriers to accessing health care for the newly insured African Americans. Participants attended an educational session about utilizing insurance and were randomized into control and intervention groups based on a health literacy pre-test. Participants in the control group received a 90-minute standard presentation. The intervention group was given a 90-minute educational session that covered the same topics as the CMS literacy program but was delivered via storytelling. Post-tests were given at the end of the session, and follow-up calls were made in one month to see if any primary care utilization had taken place. Participants in the intervention (storytelling) group had overall increased post-test scores for insurance literacy compared to the control group. Thematic elements from interviewees suggest that the largest barrier to accessing health insurance was the overabundance of literature presented in a non-digestible way.
Approximately 1 in 7 women in the United States will be diagnosed with breast cancer and approximately 1 in 3 of those diagnosed will undergo breast reconstruction surgery. Before a permanent breast implant can be positioned, the tissue must be expanded in order to allow room for the implant to be placed. A tissue expander is a silicone shell that fills with saline to expand the overlying soft tissues. Currently, patients must visit their plastic surgeon weekly to undergo saline injections for their expanders. These injections are often based upon sight and feel - which can significantly vary from surgeon to surgeon. The purpose of this project is to design a new tissue expander device that measures the pressure inside of the expander and utilizes an automated pump/reservoir system to adjust the fill volume based on an expansion protocol. The expander has the ability to significantly reduce the expansion time from 3 months - the normal expansion time for current methods, and reduces the number of hospital visits for patients post-surgery.

Our system is designed to address the emotional needs of breast cancer patients. Many of these patients that undergo tissue expansion find it painful and uncomfortable; our tissue expander system incorporates a pressure feedback system to reduce unnecessary discomfort by significantly reducing expansion time as well as hospital visits.
Synergistic Combination of Inhibitor VIII and Parthenolide Inhibits Human Prostate Cancer through Akt and NF-kappaB signaling

This research has found that the combined use of two anti-tumor therapeutic agents is more effective against prostate cancer tumors than the use of a single anti-tumor agent. This finding has many positive implications for the future of treatment of human prostate cancer.

Akt/protein kinase B and transcription factor NF-κB are recognized as critical drivers of prostate cancer progression. Akt and NF-κB are signaling molecules that are important for the control of cell proliferation, apoptosis, and oncogenesis. Previous studies have shown a progressive increase in constitutive activation of Akt and NF-κB/p65 in human prostate adenocarcinoma associated with higher tumor grade and/or stage as well as critical in developing resistance to chemotherapy. This resistance has resulted in the failure of several monotherapies that target these pathways. We hypothesize that combination therapy using Akt and NF-κB inhibitors may be more effective than previously used monotherapies. We used human prostate cancer LNCaP cells, possessing high constitutive Akt activity and PC-3 cells harboring increased Akt and NF-κB/p65 levels. The cell lines were treated with Akt Inhibitor VIII and NF-κB inhibitor Parthenolide individually and in combination. Individual treatment of cells with Akt Inhibitor VIII (0.075-1.8µM) and NF-κB inhibitor Parthenolide (0.32-60µM) for 24-72 h resulted in partial suppressive effect in cell growth. Strikingly, concurrent blocking of Akt and NF-κB/p65 at 1:10 molar ratio was found to be the most effective in inhibiting growth and in inducing cell cycle arrest in both cell lines. These effects correlated with reduced expression of p65, Ser536-p65, Ser473-Akt and downstream targets cyclinD1, iNOS, VEGF, MMP9 in both cell lines. In vivo administration of Inhibitor VIII and Parthenolide at 1:10 ratio to PC-3 tumor xenograft for 8 weeks resulted in marked decrease in tumor volume and reduced expression of target genes, compared to individual treatments. Overall, these results suggest a synergistic anti-tumor response using Inhibitor VIII and Parthenolide leading to downregulation of Akt and NF-κB expression and their downstream target genes, demonstrating that combined treatment is more effective than use of a monotherapy.
Image Reconstruction from transformed measurements is an important task in Magnetic Resonance Imaging (MRI), X-ray computed tomography, Radar imaging etc. We propose a novel two stage continuous modeling framework - Projection Correction Modeling - for image reconstruction from (non-uniform) Fourier measurements. This model consists of a projection stage motivated by multi-scale Galerkin method and a correction stage with an edge guided regularity fusing together the advantages of total variation (TV) and total fractional variation (TFV) regularity. Numerical experiments in medical imaging have been done to demonstrate its advantages.
The current techniques for energy audits are based on invasive, expensive, and time-consuming methods, of which return partially inaccurate and lengthy return on investment (ROI) estimates. The building energy efficiency project aims to create and develop a software capable of auditing the building energy with much more robust accuracy and more detail about the building performance. In this step, the building energy consumption data and weather data for various climate zones are used as input. Due to various type of problems in data such as anomalies, missing points, outliers, duplication, unit issues, etc., a multi-step cleaning process is applied to time series data to make it ready for further analysis. The preliminary analysis identifies the scheduled startup times and shutdown times of particular buildings. This analysis also can to identify light sensing buildings. Time series analysis can determine particular energy signatures of buildings and quickly identify efficiency errors, as well as provide a means for predictive analysis. In theory, heating ventilation and air conditioning (HVAC) systems constitute a major portion of building energy use and therefore energy and outside ambient temperature should correlate at high levels of confidence. Also, the developed package is capable of forecasting the energy consumption patterns for the upcoming days or even months. The result shows that the auditing capability of the software based on minimal historical inputs could give decent sights about building energy performance and developing a general methodology to have accurate energy audit is well in reach.
Exploring Factors in Gender Identity Detransition: A Case Series

Abstract

Little has been published describing factors which contribute to a person’s decision to detransition or not move forward with gender affirmation therapy once treatment has been initiated. This presentation will explore the narratives of three individuals who were seen at a LGBT health service line within a hospital system in the midwest United States. Each patient had decided to detransition at different points in their care and each cited different reasons for doing so.

Materials and Methods

The presenters will review the patients’ experience of gender affirmation therapy and health narratives as abstracted from the medical record at a hospital system in the midwestern part of the United States which provides dedicated LGBT health services. The presenters will review the relevant psychosocial, developmental, behavioral, and/or socioecologic factors affecting these patient’s gender affirmation treatment outcomes.

Results

Three patients of various ages and social demographics will be discussed:

Patients described a variety of factors affecting their decision to detransition including:

1. A personal feeling of gender incongruence with a binary identity (e.g. being exclusively male or female in gender expression/identity)
2. Challenges to personal happiness and success as a transgender person
3. Experiencing negative or traumatic events (loss of job/employment, relationship failure, lack of community acceptance/support, lack of family support, personal experience of transgender violence, undesired sex work)
4. Spiritual/religious influence on the decision to detransition.
Caregivers who do not live near the patient (distance caregivers) are in a uniquely stressful position. When should they come to visit? Is the patient telling them the whole story? What can they do to help from far away? These "distance caregivers" often feel anxious and frustrated that they are unable to get the information they need to support their loved one. The purpose of this Thematic Analysis is to examine common issues identified by distance caregivers of patients receiving cancer care at the UH Seidman Cancer Center. Sixteen distance caregivers were interviewed by an Advanced Practice Nurse or Social Worker as part of an ongoing parent study, titled "Online Information and Support for Distance Caregivers," which provides video-conference technology to connect these caregivers into the oncology appointments with the patient. The most common issues identified were concerns about local caregiver burden, communication problems with other family members, advance care planning, and a lack of social support for the patient. Communication was a common theme in these interviews. Distance caregivers expressed frustration communicating with the patient, other family members, and the health care team. It is anticipated that the videoconference will facilitate the reduction in frustration related to communication.
Epigenetic Inheritance of Diet-Induced Obesity Resistance in Mice

Abstract

Obesity affects over one billion people worldwide. Individuals that are overweight are at greater risk for other disorders, such as type 2 diabetes and cardiovascular disease; these comorbidities make obesity the sixth leading risk factor for loss of health and life worldwide. Obesity is a complex disease with heritable factors accounting for 45-75% of body weight differences among individuals. Although many risk variants have been identified, they account for a small portion of the heritability of obesity. We hypothesize that transgenerational epigenetic effects account for some of the “missing heritability” associated with obesity.

Epigenetic inheritance refers to heritable phenotypes that are not caused by changes in an organisms’ DNA sequence. When these phenotypes are inherited across multiple generations without the transmission of the original variant, it is referred to as transgenerational inheritance. Our lab used a congenic mapping approach to identify quantitative trait loci (QTL) that confer resistance to diet-induced obesity between the obesity susceptible mouse strain C57BL/6J and the obesity-resistant mouse strain A/J. Using this approach, we identified the QTL Obrq2a, and demonstrated that it was inherited in a transgenerational manner via the paternal germline. Eight new sub-congenic strains spanning Obrq2a for higher resolution QTL mapping further localized this QTL to a ~1.4 Mb region on mouse chromosome 6, QTL Obrq2a-A. A series of backcrosses using the new congenic strains will determine how many generations diet-induced obesity resistance is conferred. In addition, we will look at global transcriptome modifications caused by Obrq2a-A through RNA-seq. These studies will identify a new gene that controls this atypical inheritance of a metabolic disease, thereby shedding new mechanistic insight into this poorly understood and underappreciated process.
Due to the increasing complexity of managing multiple chronic conditions (MCC), the adult population living with MCC is experiencing high levels of treatment burden (TB). The definition of TB is the self-management and coordination of health services patient must do in order to manage MCC resulting from the prescribed plan of treatment and disease trajectory. TB is associated with poor treatment adherence, which contributes to poor health-related outcomes, higher health care resource usage, and higher associated health care costs.

A population that may be highly susceptible to TB is the adult population transitioning from a skilled nursing facility (SNF) to home. This population has a higher than average incidence of MCC, a greater number of total MCC, a higher use of healthcare resources, and a higher incidence of readmission as compared to adults not receiving PAC in a SNF. Additionally, the interface with transitional care and home care is essential in the care of this home going population. There is strong evidence in the literature that the use of transitional care and home care in medically complex individuals improves health outcomes and reduces avoidable readmissions, thus, establishing a need to measure the association of these variables to TB as part of the phenomenon.

Current MCC research is limited and descriptive in nature. Constructs of TB: (a) causes, or antecedents of TB, (b) the level of TB in specific populations, and the (c) outcomes of TB, have not been adequately measured. Therefore, the purpose of study was to describe three constructs of TB: (1) the level of subjective TB experienced by this population, (2) the association between TB and potential antecedents, and (3) an exploration of changing levels of the antecedents of TB and TB from baseline at a SNF to 30 days after discharge home.

Eighty-two adult participants diagnosed with MCC transitioning from SNF to home were enrolled in this exploratory, descriptive study. This longitudinally designed study collected data at two time points: baseline prior to SNF discharge and 30 days post-discharge.

Analysis of this data resulted in a TB score (out of 150, with higher numbers indicating a higher level of TB) at baseline of (M= 39.06, SD= 25.97) and 30-day post-discharge home (M= 37.01, SD 24.45) in the study sample. This study characterized and correlated antecedents of TB at conceptual levels three levels: interpersonal, intrapersonal and organizational. The antecedent factors of anxiety, depression, fatigue, pain interference, pain intensity, physical function, the number of MCC, the severity of...
Introduction: Percutaneous mechanical thrombectomy (PMT) is used in the treatment of venous and arterial thrombosis. PMT has been linked to cases of reversible post-operative acute kidney injury. The purpose of this study is to evaluate the risk of renal dysfunction in patients undergoing PMT vs. catheter-directed thrombolysis (CDT) for treatment of an acute thrombus.

Methods: This study is a retrospective review of all patients in a single institution with a CPT code for PMT or CDT from January 2009 through December 2014. Each patient was grouped into one of the 4 following procedural categories: PMT only, PMT with tPA pulse-spray, PMT with CDT, or CDT only. Pre-operative and post-operative creatinine and GFR values were obtained for each patient. The RIFLE criteria was used to categorize the extent of renal dysfunction.

Results: A total of 227 patients were reviewed, of which 82 were excluded due to either existence of preoperative acute kidney injury, history of end stage renal disease, or lack of clinical data. Of the remaining 145 patients, 53 (37%) presented with arterial thrombosis (mean age 62, 43% male) and 92 (63%) presented with venous thrombosis (mean age 48, 45% male). The incidence of renal dysfunction was highest in the PMT/tPA pulse group (21%), followed by the PMT group (20%) and the PMT/CDT group (14%). CDT was not associated with renal dysfunction. PMT (P = .046) and PMT/tPA pulse (P = .033) were associated with higher rates of renal dysfunction than the CDT controls. The minimum post-operative GFR within 48 hours was an average of 35.0 ± 15.5 mL/min/1.73m². Stratified by the RIFLE Criteria, 13 (9.0%) patients progressed to the Risk category, 6 (4.1%) progressed to the Injury category, and 3 (2.1%) progressed to the Failure category.

Conclusion: The use of PMT as a treatment for vascular thrombosis is associated with renal dysfunction. Patients treated with PMT require postoperative vigilance and renal protective measures.
Dancetricians: A hip hop dance intervention to improve physical activity self-efficacy and motivation among urban minority school children

Background: Nationally, one out of five school children is obese, with higher rates among urban minority youth (55%). Furthermore, only 42% of elementary school children engage in the recommended levels of physical activity. Our goals were to develop and evaluate a street dance afterschool program in an urban public school, designed to spark children’s interest in routine physical activity.

Methods: Dancetricians is an afterschool program developed and taught by medical students with an interest in dance, designed to spark urban minority children’s interest in routine physical activity. Using surveys validated for ages 9 to 11, we found that children exhibited improved self efficacy and motivation to exercise following program participation.

Results: Twenty-two students ages 8 to 12 were enrolled in Dancetricians (86% Black; mean age of 10.0 years). While there was no change in the frequency of physical activity pre vs. post intervention; on average, children scored higher on the physical activity self-efficacy (7.3 to 9.1, p=.005) and motivation (3.4 to 4.0, p=.03) scales following program participation. Specifically, following participation, more children reported that they can be physically active after school (p=.004), ask their parent to sign them up for a sport or dance (p=.05), and ask their friend to exercise with them (p=.02). With regards to motivation, more children believed that being physically active would not be boring (p=.007), help them be healthy (p=.04), keep them in shape (p=.03), and make them better in sports (p=.009).

Discussion: Participating in a street dance afterschool program may be associated with improved self-efficacy and motivation to exercise among urban minority children.
We sought to explore perspectives in older breast cancer survivors from diverse racial and socioeconomic backgrounds towards physical activity to inform the design of a physical activity program that fosters sustained participation.

We enrolled 60 participants, 65 years and older, within 2 years of treatment completion for stage I-III breast cancer, with 10 participants or more in each of four strata defined by race [African American vs Non-Hispanic White] and socioeconomic status [disadvantaged vs non-disadvantaged]. Participants completed open-ended, semi-structured interviews and focus group. Cohort’s mean age was 71, 50% were African American and 52% were socioeconomically disadvantaged. Participants stated that physical activity was important because it “increased energy”, “helped the body”, “reduced stress”, and “improved mental and emotional” state. Participants reported health issues, especially side effects from cancer treatment and other age-related ailments, as barriers to exercise participation. Facilitators were religious faith, community and family. Preferences were moderate intensity exercises, 1 hour morning sessions, 2-3 times a week, variety in routine, inclusion of social activities, health calendar use, contracts, tracking devices and buddy system. Walking, stationary bikes, resistance bands and free weights were preferred exercises.

Although African American and non-disadvantaged participants stated that culture and race/ethnicity influenced their physical activity perspectives, minimal differences were reported in attitudes and preferences by race and socioeconomic status. Among older breast cancer survivors, attitudes and preferences toward physical activity were shaped by age and the cancer experience, rather than by culture and race/ethnicity. Physical activity programs for older breast cancer survivors should focus on addressing age and cancer treatment-related concerns to ensure acceptability and sustained physical activity participation.
Microalgal-bacterial flocs result from the symbiotic relationship between heterotrophic bacteria and microalgae, and have been proposed for application in wastewater treatment. However, in addition to wastewater treatment, these flocs could also be used for the simultaneous production of algal biomass for biofuel. Compared to activated sludge, microalgal-bacterial flocs increase oxygen and carbon dioxide exchange between microalgae and associated heterotrophic bacteria. They also exhibit high settleability and are more robust than algal monocultures. Our goal is to produce microalgal-bacterial flocs with lipid-rich algae with both high waste treatment efficiency and high value as a biofuel feedstock.

We operated photobioreactors containing a mix of 5:1, 2:1, 1:1, and 1:5 (weight/weight) microalgae to activated sludge for the production of microalgal-bacterial flocs. The lipid-rich algae strains C. sorokiniana, C. vulgaris, S. dimorphus, and N. oleoabundans were used for comparison in four sets of reactors. We analyzed the lipid composition of the flocs, floc settleability and characteristics (including chlorophyll a content), abundance of the bioaugmented microalgal strain over time, and wastewater treatment parameters in reactor effluent.

This research helped to assess the viability of bioaugmented microalgal-bacterial flocs as a biofuel feedstock, including which species and ratios of algae to bacteria will produce microalgal-bacterial flocs with desired characteristics. In future studies, we will examine long-term stability and productivity of these flocs in larger-scale reactors.

Crop protection and cost efficiency are important aspects of algal cultivation for biofuel production. Our research uses mixtures of microalgae and bacteria to produce more robust algal cultures for biofuel production, which can be fed with wastewater for cost and energy savings.
The Advanced Manufacturing and Mechanical Reliability Center (AMMRC) was established in 1987 to provide advanced manufacturing (e.g. deformation processing, extrusion, forming, etc.) and mechanical characterization (e.g. mechanical testing, reliability testing, fatigue, etc.) expertise to the CWRU campus, medical, industrial, legal, outside university, and government laboratory communities. The Center, housed in the Charles M. White Metallurgy building, currently maintains equipment valued in excess of $4.5M and has been accessed by the local, national, and international communities. The CWRU campus community can access the facility via the use of a valid CWRU account number that will be charged at an internal rate for machine time, including set up and any technician time involved. Long term testing can be provided at pro-rated charges in consultation with the Center Directors. Arrangements can be made to train users on the equipment and reserve time for equipment use by contacting the Center co-director. Outside (i.e. non-CWRU) users can access the facility via a number of different mechanisms by contacting the Center Director. Remote access and/or monitoring of testing is possible.
(Co, Ni)-based nanocrystalline alloys (Co1-xNix)88Zr7B4Cu1 have shown promise with coercivity less than 50 A/m, which could be used in energy-related applications such as inductors, high and low frequency transformers, AC machines, motors, generators and magnetic amplifiers[1]. Coercivity measurements against composition with (Co, Ni)-based nanocomposites (x = 0, 0.25, 0.5, 0.75, 1)[2] indicates a plateau when 0.50 ≤ x ≤ 0.75. This phenomenon could be explained by our proposed model considering composition dependence of magnetostriction and magnetocrystalline anisotropy in these alloys. (Co1-xNix)88Zr7B4Cu1 around x = 0.684 could have a coercivity less than 10 A/m while maintaining high saturation magnetization, as predicted by our model. (Co, Ni)-based nanocomposites with this composition are prepared by melt spinning followed by isothermal annealing at the primary crystallization temperature, following the same procedure previously used[2]. Room temperature magnetic hysteresis and temperature dependent magnetization have been studied. Coercivity and magnetostriction data from this work will be used to validate our proposed coercivity model.
Abstract

One-dimensional (1D) carbon nanotubes (CNTs) and 2D single-atomic layer graphene have superior thermal, electrical, and mechanical properties. However, these nanomaterials exhibit poor out-of-plane properties due to the weak van der Waals interaction in the transverse direction between graphitic layers. Recent theoretical studies indicate that rationally designed 3D architectures could have desirable out-of-plane properties while maintaining in-plane properties. 3D structure of graphene nanomaterials can be well controlled via chemical vapor deposition method. These 3D graphene nanomaterials, with a controllable surface area, meso-/micropores, and superior electrical properties, are excellent electrode materials for all-solid-state wire-shaped supercapacitors, exhibiting high surface-specific capacitance. These novel 3D graphene nanomaterials based energy conversion, and storage devices are so flexible they can integrate into fabrics as power sources.
Optimal Control of Time Varying Non-Linear Systems using Deep Neural Networks as a Dynamic Programming Engine

Using a series of weak classifiers allows for sets of information to be output. These sets can easily be trained to represent all optimal control space.

Nonlinear time varying systems such as legged robotics are extremely difficult to control. Most of these systems have high degrees of freedom and analytical models are impractical or impossible to solve. New advancements in deep learning have allowed data driven solutions to be found using deep neural networks. Most researchers use networks that have many hidden neurons as to allow the input to be projected in to higher dimensional space. While this use is great for categorization it is impossible to train systems that have multiple solutions for a single input. This is extremely problematic when trying to find an optimal controller since many states will have many solutions. Also any fully connected network that has varying neurons per layer are either under determined or over determined and leave a solution space that is infinite within a bounded area. To counter both of these issues, a series of weak bijective fully connected neural networks are used to model the time varying dynamics of a system. The series of classifiers allows for multiple solutions for state to state transitions and allows searching through the entire optimal control space to find all solutions to the problem.
Medtronic’s ECVUE electrocardiographic mapping system uses a disposable vest of electrodes and a mapping amplifier to create an electrical map of the heart. Currently, the verification process includes a test fixture with manual switches and manual adjustment of a waveform generator to test the mapping amplifier. This testing takes several hours to complete and has a high possibility of human error. We automated the test process by replacing the manual switches with digital switches and controlling the function generator with LabVIEW. Additionally, we removed the need to export data to Microsoft Excel for analysis by implementing more efficient computation methods in LabVIEW. Our test system does not require human input once it is set up and tests have been initiated. At the completion of testing, the system returns a summary report of data from four verification tests, complete with all required analysis and a conclusion of whether test specifications have been met successfully. While the current manual test methods have been thoroughly documented and approved for use by the Food and Drug Administration, our approach will benefit the company by saving time and money to produce the required data, all with the lower likelihood of human error.
Background: Contraception and pregnancy planning are critically important for patients with sickle cell disease (SCD). However, rates of contraceptive utilization are often suboptimal and unplanned pregnancy remains a problem among this patient population. In an effort to improve care, a multidisciplinary hematology and gynecology clinic was initiated at University Hospitals Case Medical Center in which women of reproductive age received comprehensive care in single visits.

Objective: To determine the impact on pregnancy, contraception use and sexually transmitted infections (STIs) diagnoses of a multidisciplinary hematology and gynecology clinic for women with SCD.

Methods: A retrospective cohort study of women seen in University Hospitals Hematology Clinic for sickle cell disease from 2011 to 2015. Baseline demographics as well as the subsequent outcomes of pregnancies, contraception use and STIs were collected. Total differences in outcomes before and after the multidisciplinary clinical were evaluated with Fisher’s exact test. Longitudinal differences in pregnancies and STIs were analyzed with time-to-event analyses. For outcomes of interest p charts were constructed with upper and lower control limits.

Results: A total of 133 women total were identified as reproductive age women with sickle cell disease from 2011 to 2015. The percentage of SCD patients using birth control before and after the multidisciplinary clinic increased from 12.3% to 37% (p=0.0001). The p chart for contraception use is provided bellow and was highly significant. No significant differences in pregnancy or STIs were identified in time-to-event analysis and p charts, though the total number of STIs before and after the intervention was limited (eighteen).

Conclusion: Incorporating a multidisciplinary approach with combined hematology and gynecology care for women with sickle cell disease has the potential to improve access to contraception use in this population.
Two of the most dreaded complications of cardiac surgery are stroke and death. One purported mechanism is the introduction of arterial cannula into atherosclerotic plaque, causing showering of debris to the brain. In order to minimize the risk of these complications, extensive preoperative testing is performed, including chest x-ray, coronary angiography and echocardiography. However, none of these imaging techniques is best suited for imaging atherosclerotic changes that exist around the aorta and great vessels. An alternate method is to directly apply an ultrasound probe to the aorta, after sternotomy, prior to initiating bypass. However, this method increases operative time and can only assess the ascending aorta. Another method, computed tomography (CT) of the chest is frequently used for re-operative cardiac surgery to assess safety of re-entry into the chest. Some centers have started using chest CT in primary cardiac surgery. The purpose of this study was to review the existing evidence, in order to answer the following question, “in patients undergoing primary cardiac surgery, does routine preoperative CT imaging provide clinical benefit as measured by either a decrease in complications or a change in surgical approach?” Altogether, 125 papers were found, of which 5 represented the best evidence to answer the clinical question. All five studies reviewed reported change in operative strategy as a result of preoperative imaging, with the most common change being an alternative cannulation site. Two comparative studies reported decreased mortality and decreased perioperative stroke in patients who undergo preoperative CT, when compared to patients who do not, although one study selected high-risk patients for pre-operative CT, rather than routine use. We conclude that pre-operative computed tomography can decrease post-operative stroke rate and mortality and help optimize operative strategy in patients undergoing primary cardiac surgery.
Dental Fear Among Transgender Individuals

Abstract

Objectives: The aims of this study were to evaluate levels of dental fear among transgender individuals and to investigate associations between gender identity (GI) and dental fear.

Methods: A survey asked about dental fear (Dental Fear Survey (DFS)), fear of being discriminated against/maltreated in the dental clinic and gender characteristics. We asked their gender identity by two steps: whether participants considered themselves to be transgender/gender non-conforming (yes/no) and how they describe their gender identity (e.g., transgender male). Questions were adopted from the National Transgender Discrimination Survey.

Results: Sixty-nine transgender individuals participated in this study (mean (s.d.) age=37.0(16.1), range 18-76 years). The number of transgender male (TM), transgender female (TF) and non-conforming (NC) individuals were 25, 30 and 14, respectively. The mean (s.d.) of DFS scores for TM, TF and NC were 44.7 (17.8), 47.9 (20.7), and 58.1 (19.4), respectively. Analyses of variance found no significant differences in DFS scores among GIs (F=2.24, p=0.115). There was a significant correlation between fear of discrimination in the dental clinic and dental fear (Pearson’s r = 0.45, p<0.001). A regression model with DFS as the independent variable and GI, age and fear of discrimination as dependent variables was significant (F=4.22 (4,58), p=0.005, R^2=0.25). Standardized coefficient of the fear of discrimination was 0.42 (p=0.001), while the other dependent variables were not significant.

Conclusion: The fear of discrimination in the dental office was significantly associated with dental fear among transgender individuals. Dental providers should be aware of patients’ fear of discrimination among the transgender community. Investigations are needed to examine the role of gender in the dental fear level, which has been constantly reported at greater levels in females than in males.
### Abstract

Three decades of research has demonstrated a profound negative association between experiencing homelessness and child development. The research literature is replete with explanations about how homelessness negatively affects children throughout the lifespan; however, the relational dynamic between parent and child is largely absent. The purpose of this poster is to propose an expansion of an existing framework, Abidin’s Parenting Stress Model, and examine its fit with parent’s self-reported experiences of living in an emergency shelter. Abidin’s original framework focused exclusively on parents’ lived experiences, omitting their relationship with their children. We propose the inclusion of children in the model, emphasizing the parent-child dyad as the central focus.

Consistent with prior literature, the 19 parents interviewed in this study reported feeling disempowered while living in an emergency shelter with their young children. The chaos of homelessness and parenting in the public sphere was found to alter their authority over their children in ways that they perceived to be negative. Furthermore, many parents also self-reported negative physical, emotional, and behavioral impacts of shelter life on their children.

The qualitative data collected in this study support the inclusion of the parent-child relationship to Abidin’s original framework. The expanded framework suggests the association between homelessness and negative child outcomes is mediated through the parent-child relationship. We believe that understanding parents’ lived experiences in shelter offers insight into how current homeless system dynamics, such as rules, policies, and staff oversight, affect the parent-child relationship. From the expanded framework, researchers offer recommendations for future research and practitioner considerations for supporting parents with young children in shelter.
# Heteroatoms-doped carbon nanomaterials can act as low-cost, efficient, durable, and high-performance electrocatalysts for proton exchange membrane fuel cell, thus greatly reducing the cost of fuel cells and contributing to the commercialization of fuel cell technology.

## Abstract

The availability of low-cost, efficient, and durable catalysts for oxygen reduction reaction (ORR) is a prerequisite for commercialization of fuel cell technology. Along with intensive research efforts of more than half a century in developing nonprecious metal catalysts (NPMCs) to replace the expensive and scarce platinum-based catalysts, a new class of carbon-based, low-cost, metal-free ORR catalysts was demonstrated to show superb ORR performance in both alkaline and acidic fuel cells.

We have developed various rational approaches to heteroatoms (e.g., N, S, Cl, Br, I)-doped carbon nanomaterials (carbon nanotubes, graphene, graphite) as highly active metal-free electrocatalysts for ORR in both alkaline and acidic fuel cells. Furthermore, the metal-free, nitrogen-doped carbon nanotubes and their graphene composites were demonstrated to exhibit significantly better long-term operational stabilities and comparable gravimetric power densities with respect to the best NPMCs in acidic PEM fuel cells.
Photocyclic Behavior of Rhodopsin Induced by a Novel Isomerization Mechanism

Vertebrate rhodopsin (Rh) contains 11-cis-retinal as a chromophore to convert light energy into visual signals. On absorption of light, 11-cis-retinal is isomerized to all-trans-retinal (ATR) that causes a conformational change in the opsin moiety propagating the visual photo-transduction. The process is culminated by the release of ATR that is converted back to 11-cis-retinal by a complex set of reactions catalyzed by retinoid cycle enzymes. Mutations in genes coding for any of these enzymes causes retinal degeneration due to the accumulation of ATR by-products in the retina. What if there is a

Abstract

Vertebrate rhodopsin (Rh) contains 11-cis-retinal as a chromophore to convert light energy into visual signals. On absorption of light, 11-cis-retinal is isomerized to all-trans-retinal, constituting a one way reaction that activates transducin (Gt) followed by chromophore release. Here we report that bovine Rh, regenerated instead with a 6-carbon ring retinal chromophore featuring a C11=C12 double bond locked in its cis conformation (Rh6mr), employs a novel retinal isomerization mechanism by converting 11-cis to an 11,13-dicis configuration for prolonged Gt activation. Time-dependent UV-Vis spectroscopy, HPLC and molecular mechanics (MM) analyses revealed a thermal re-isomerization of the 11,13-dicis to the 11-cis configuration on a slow time scale, which enables Rh6mr to function in a photocyclic manner similar to that of microbial Rhs. With this photocyclic behavior, Rh6mr repeatedly recruits and activates Gt in response to light stimuli, making it a great candidate for optogenetic tools based on retinal analogue-bound vertebrate Rhs. Overall, these comprehensive structure-function studies unveil a unique photocyclic mechanism of Rh activation by an 11-cis to 11,13-dicis isomerization.

Reference:

Humans perceive light by the isomerization of 11-cis-retinal to all-trans-retinal (ATR) that causes a conformational change in the opsin moiety propagating the visual photo-transduction. The process is culminated by the release of ATR that is converted back to 11-cis-retinal by a complex set of reactions catalyzed by retinoid cycle enzymes. Mutations in genes coding for any of these enzymes causes retinal degeneration due to the accumulation of ATR by-products in the retina. What if there is a
### Abstract

**Purpose:** Endometriosis is a progressive condition in which ectopic endometrial tissue is located outside of the uterus and can cause abdominal pain, dysmenorrhea, and infertility. The prevalence of endometriosis is estimated to be between 5-10% of cisgender women. Transgender men who undergo masculinizing therapy may also experience the symptoms of endometriosis, but lack the menstrual signs due to estrogen hormone suppression. A PubMed search for MESH terms "endometriosis," "transgender," "transsexual," and "transman" did not reveal any published reports.

**Materials and Methods:** We present a case report of a 31 year old transman who had presented to our clinic for routine care including masculinizing hormonal care and chronic abdominal pain which ultimately was diagnosed as endometriosis 8 years after presentation.

**Results:**

The patient underwent a comprehensive evaluation including laboratory studies, upper endoscopy, colonoscopy, and abdominal imaging which all were non-diagnostic. He moved out of state and was lost to follow-up for 4 years. He returned for care in 2012 and still complained of abdominal pain. He was referred to an affirming gynecologist. The patient underwent a routine gynecologic exam which was normal. He had an pelvic ultrasound was normal. His pain progressed and then changed in quality. The pain was not only upper abdominal but now involved the right hemipelvis. He was seen again by gynecology, this time with a plan for laparoscopy to see if he had developed endometriosis. The patient underwent vaginal hysterectomy and oophorectomy and was noted to have left pelvic sidewall lesions consistent with endometriosis at the time of surgery. Anatomic specimens were sent for histology which did not demonstrate the presence of endometriosis in the sample.
The goal of this study is to automatically detect potentially destabilizing conditions faced by manual wheelchair users with spinal cord injuries and activate the appropriate muscles to prevent falls and stabilize the seated operator. Wireless inertial measurement units with tri-axial acceleration and gyroscopic sensors were mounted on the wheelchair frames and backs of two individuals with low cervical and thoracic level injuries. Subjects sat passively in a manual wheelchair attached to a guidance track as it descended a ramp to ensure consistent velocity through a sharp 90 degree turn and sudden stop simulating a collision. An algorithm using the accelerometer and gyroscopic data was created to detect the turns and collisions, and trigger appropriate stimulus patterns. Acceleration in the anterior and posterior (A/P) and angular velocity in the superior and inferior (S/I) direction provided distinct features to discriminate between destabilizing collisions and turns, respectively. During calibration, collision thresholds were determined by taking the mean of the maximum A/P acceleration peak from 20 trials and subtracting two standard deviations. The turn thresholds were determined in the same way using the S/I angular velocity. During testing, the algorithms were applied in real time to activate a pre-programmed pattern to oppose lateral bending or prevent forward leaning and maintain erect posture throughout the events. Subjects rated their perceptions of safety with and without stimulation via the Usability Rating Scale (URS). Subjects reported a significantly increased feeling of safety and stability during collisions (Z = -2.539, p = 0.011) with a median URS score of 1.5 with and -1.5 without triggered stimulation to the appropriate muscles to resist the destabilizing event. Similarly, during turns, subjects felt a significant increase in safety and stability (Z = -3.100, p = 0.002) with a median URS score of 0 with and -1 without triggered stimulation.
Abstract

Scour is a natural phenomenon caused by erosion or removal of streambed or river bank materials around bridge foundations by the stream. Various countermeasures have been proposed and improved to ensure the safety of bridge foundation against scour. These methods can be grouped into two major categories, i.e., negative and positive countermeasures. Negative countermeasures aim at enhancing the ability of the bed material to resist erosion. While positive countermeasures are designed to reduce the erosive power of the stream. This study presents both experimental study and numerical simulation to investigate the effects of an innovative sacrificial piles concept to reduce local scour surrounding service piles. These sacrificial piles are placed upstream of the pile groups, which serves to change the flow field and reduce the erosive force before it reaches the service piles. Scaled experiments were conducted in flume for each group of design, local scour around piles with and without sacrificial piles were monitored. It was found that the sacrificial piles effectively reduced the development of local scour surrounding the service piles, especially at their heels. The results also showed that the use of sacrificial piles reduced the time required for the scour depth to reach the equilibrium conditions than those without the sacrificial piles. To corroborate the experimental observation, numerical simulation with three-dimensional computational fluid dynamics model has also been carried out with commercial code with verified erosion model. The development of dynamic scour process and maximum scour depth were obtained by the computational simulations. Comparison of experimental and computational results both indicate that the use of sacrificial pile is effective in reducing the scour depth.
To explore the depths of the hydrocarbon rich seas on the Saturn moon Titan for a one year direct mission, a conceptual design of an unmanned, fully instrumented, and fully autonomous submarine was recently developed for NASA Innovative Advanced Concept (NIAC). Titan represents a unique deep space exploration location because it is the only known body (other than Earth) within the Solar System with stable surface seas. The cryogenic hydrocarbon seas are composed primarily of liquid ethane and methane at a surface temperature of approximately 93K. Additionally, Titan is the only known moon with a significant atmosphere; at the surface, the pressure is 1.5 bar, and the composition is 95% gaseous nitrogen and 5% gaseous methane. Therefore the cryogenic environment on Titan represents a unique design challenge for exploration vehicles. The designed submarine meets all science exploration objectives, which are geological and astrobiological in nature, which include capability to study atmosphere/sea exchange, interact with the seabed, hover within the seas, traverse large distances with limited energy, capability to operate within variable concentrations of ethane and methane, and tolerate large differences in density and viscosity.

This presentation will focus on the current NIAC Phase II design of the submarine, which represents a much simpler, more cost-effective, and packaged design due to the availability of an orbiter to relay signals around Saturn. Current thermal design concerns and mitigation strategies will be examined. The updated science objectives, mission timeline, and mission concept of operation will also be shown. Finally, the presentation will cover results from the most recent Cassini fly-bys and how the new data impacts design of the submarine and timing of the mission.
Abstract

Objective: Tendon and ligament injuries are common occurrences in the United States. 3D-biotextiles made from pure collagen have been shown to stimulate tenogenesis which demonstrates its promise as a candidate for the use in repairing ligaments and tendons. Electrochemically Aligned Collagen (ELAC) threads can be woven into 3D structures. These structures could then be used to reinforce traditional tendon suturing techniques. A proxy material for the ELAC with a similar tensile strength and diameter needed to be located and qualified. A mechanism for forming 10 and 16 thread cylindrical knitted structures was also required. Our hypothesis was that a proxy material for ELAC could be identified, qualified, and be used to test various scaffold designs for ultimate tensile strength (UTS), manufacturability, and fit for use. We also hypothesized that a 16 thread cylindrical knitted structure would have a statistically significant higher mean UTS compared to a 10 thread cylindrical knitted structure. Methods: Three candidate threads were tested for UTS and measured with hand calipers for diameter. A custom knitting machine was constructed by modifying a commercially available Embellish-Knit! knitting machine. Knitted structures were tested for UTS by loading them in a tensile test machine and applying a constantly increasing force until failure. Results: One of the threads had a mean UTS and diameter similar to that of the ELAC thread. The 10 and 16 thread structures had statistically different mean UTS (n=10, p<0.05). Conclusion: The Coats Transparent polyester thread is an acceptable proxy material that can be used to evaluate knitted ELAC structures. The 10 and 16 thread results show a statistically significant difference between the two structures, that the strength per thread remains relatively constant, and that the variation in macro structure tensile strength appears inversely proportional to the number of threads.
Abstract

About 1 in 8 women in the U.S. develop invasive breast cancer during their lifetime. Metastasis, the invasion of cancer cells to distant healthy organs after detaching from the primary tumor, causes much lower survival rates among cancer patients. The ability to manipulate and pattern cancer cells at the microscale level can open an avenue to study cancer cell properties and behaviors, which may lead to new understandings of cancer metastasis. The objective of this research is to fast, non-invasively manipulate single cancer cells with microscale accuracy via a micromechanical resonator platform. Silicon nitride (Si3N4) diaphragm resonators (350×350×0.6µm3) were fabricated based on Si3N4-on-Si wafers and released by TMAH backside etching of Si substrates. The diaphragms were mounted onto piezoelectric shakers, which oscillated vertically (at 10kHz–1MHz) to excite the devices' transverse mechanical motions. Specific patterns known as 'Chladni figures' were created when a group of metastatic breast cancer cells (MDA-MB-231, ~15µm-diameter) were dispersed onto the diaphragm surfaces while the piezoelectric excitation frequencies matched the devices' resonance frequencies. These patterns, formed within seconds and in a sequence, were in good agreement with the calculated resonance mode shapes. Such multimode resonators provide a unique platform for non-invasive, quick manipulation and patterning of cancer cells which could lead to future studies on probing breast cancer cell properties and interactions and their connections with cancer metastasis.
Wouldn’t it be great to have a material that could adapt to changing thermal conditions? Imagine a shirt that could keep you warm in the morning and switch to cooling your body as the day warms or you become more active. We are developing a material that can do this.

This project seeks to develop a class of “smart” materials that can be switched from a low thermal conductivity state to a high conductivity state and back. These composite materials consist of high conductivity fibers embedded in a shape-memory polymer matrix. The fibers can be directed from a disordered arrangement (low thermal conductivity state) to an aligned structure (high thermal conductivity state) through application of an external stimulus (electrical, mechanical, thermal). The properties of the polymer matrix allow for the aligned configuration to be locked in and also for the previous disordered state to be remembered; this material memory permits reverting to the insulating state if desired. We present initial results from this development effort including the thermal properties of individual, nanoscale fibers as well as the thermal conductivity of shape-memory polymer composites made from these fibers.
Regulatory T cells exhibit distinct lymph node homing and trafficking kinetics as compared to conventional CD4+ T cells

Regulatory T cells (Tregs) express the canonical marker Foxp3 and are critical for suppressing the immune response in homeostatic and inflammatory conditions. Despite how widely studied CD4+Foxp3+ Tregs are in mice, their physiologic trafficking and scanning behavior of antigen-presenting cells in secondary lymphoid organs (SLOs) have yet to be quantitatively analyzed in the intravital setting. We have previously described the dynamics of T cell trafficking through SLOs and scanning of dendritic cells (DCs), revealing that CD4+ T cells and CD8+ T cells exhibit different transit kinetics through lymph nodes (LNs). On average, CD4+ T cells spend less time scanning for self-peptide/MHC (self-pMHC), dwell shorter in LNs, and egress faster compared to CD8+ T cells. Here we use flow cytometry and 2-photon laser scanning microscopy (2-PLSM) to quantitate the homeostatic trafficking behavior and surveillance strategy of Tregs in LNs and to compare their behavior to conventional T cells (Tconvs). Our data reveal significant differences in Treg versus Tconv homing and transit through peripheral and mesenteric LNs. We find that Tregs with an effector phenotype are preferentially retained in LNs, and complementary transwell assays demonstrate that Tregs have blunted response to CCL21 compared to Tconvs. Finally, we use intravital 2-PLSM to quantify the contribution of self-pMHC recognition to Treg kinetics and scanning of DCs in peripheral and mesenteric LNs, taking advantage of a novel gut SLO stabilization device allowing up to 10 hours of continuous imaging. These results add quantitative data to the emerging paradigm that self-pMHC interactions dynamically control homeostatic Treg retainment and localized suppressive function in LNs.
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**Author Affiliation**: Case Western Reserve University  
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**Elevator Speech**: HexConnect, HexPath, and Guppies are all hexagonal tile games that revolve around the same (or similar) data sets but with distinctly different rules and outcomes.

**Key Words**  
game design  
topology  
gaming  
art

**Abstract**  
HexConnect, HexPath, and Guppies are all hexagonal tile games that revolve around the same (or similar) data sets but with distinctly different rules and outcomes. This interactive booth and poster is a case study on the games’ design, implementation (though print on demand game services) and how simple rule changes and motifs can create vastly different experiences.
Mitophagy is Required for Brown Adipose Tissue Homeostasis During Thermogenic Adaptation

Brown adipose tissue (BAT) has given mammalians an evolutionary advantage through non-shivering heat production in adaptation to colder temperatures. Although known to be existent in other mammals, the presence of brown adipose tissue in adult humans has been discovered only within the last few decades. In our research, it is evident that mitophagy plays an important role in maintaining brown adipocytes' homeostasis.

Abstract

Brown adipose tissue (BAT) has given mammalians an evolutionary advantage through non-shivering heat production in adaptation to colder temperatures. Although known to be existent in other mammals, the presence of brown adipose tissue in adult humans has been discovered only within the last few decades. Brown adipocytes, the functioning unit of brown adipose tissue, have been known to be activated via adrenergic pathways and mitochondrial proteins, especially UCP1, mediating its non-shivering thermogenic function. Although it is known that mitochondria play a key role in brown adipocytes function, there is limited research on mitochondrial homeostasis during colder temperatures in these cells. For 7 days, mice were exposed to cold temperature (4°C) and were compared to mice at thermoneutral temperature (30°C). The presence of autophagy markers (i.e. LC3, p62) and various mitochondrial proteins (i.e. UCP1, ATP5A) were subsequently tested. Compared to 30°C, 4°C-challenged mice BAT showed marked elevation in mitochondrial membrane proteins indicating activated mitochondria function. Most importantly, our results show increased autophagy markers in 4°C-challenged-BAT compared to at 30°C. Additionally, pharmacological and genetic blockade of mitophagy in mice were conducted. Blockade of autophagy pathways in cold-challenged mice showed morphological abnormalities in-vivo and decreased mitochondria OX-PHOS function in-vitro. Our results show that mitophagy plays a crucial role in brown adipocyte integrity and function. Finally, we found that mitophagy coordinates with mitochondrial biogenesis to further maintain mitochondrial homeostasis.

This study shows that collection of site specific thermal data will help to improve the design of GCHP to achieve cost effectiveness and reliable performance.
The transport of fluid within a porous medium is influenced by its morphological properties (void and interconnecting window size) and its interfacial interaction with the fluid. In this study, high-porosity open-celled polymer foams (polyHIPEs) were prepared by an emulsion templating method. PolyHIPEs with various void sizes, window sizes and porosities were engineered through selection of the mixing conditions and droplet-phase volume fraction in the precursor emulsion. Pore morphology (imaged through scanning electron microscopy) was also tuned by varying the initiator types. Permeability tests were conducted to characterize the morphological effects on polyHIPE transport properties. The fluid-porous medium interaction was evaluated by studying the spontaneous imbibition of water/oil into polyHIPE. The size of the windows that interconnect neighboring pores was found to be the parameter that predominantly controls both the permeability and the spontaneous imbibition process.
The purpose of this research is to gain student perspectives and feedback on Case Western Reserve University's continuing Active Learning Fellows program. This program, run by the Teaching and Learning Center at UTech, has been active for the past few years, and is responsible for helping faculty create new and innovative ways to teach using active learning techniques. At the end of each year, student feedback is collected in order to help improve the program and to assess the effectiveness of active learning techniques. This presentation summarizes the data we have collected over the past year and draws conclusions concerning student perception on their active learning experiences based on those summaries. In particular, we highlight that all students find the same level of engagement towards active learning, regardless of whether they are international students or non-English primary speakers.
Prostate cancer (PCa) accounts for more than one in five new cancer diagnoses in the United States. While localized PCa has excellent prognosis with several curative treatment modalities, castration resistant prostate cancer (CRPC) remains lethal with survival on the range of 14-26 months. CRPC describes an inevitable advanced manifestation of disease, during which biochemical or radiographic disease progression is observed despite castrate levels (<50 ng/mL) of serum testosterone. Despite the numerous FDA-approved therapies that have emerged for CRPC, challenges in treatment remain due to the development of resistance to the various modalities of androgen deprivation. In addition, there is little consensus on treatment order of the six approved CRPC therapies to maximize clinical benefit, an important therapeutic consideration given the emergence of cross-resistance between therapies. Our analysis seeks to compare the efficacies of abiraterone and enzalutamide, two prominent androgen signaling inhibitors, in the pre- and post-chemotherapy settings in hopes of determining which line of treatment can show the greatest improvement in patient survival.

We performed a meta-analysis by searching PubMed for eligible studies from January 2008 to November 2016; 20 studies, containing 17 median OS estimates and 13 median PFS estimates, met our inclusion criteria. The results reveal no significant difference in median survival measures when comparing enzalutamide to abiraterone in the post-docetaxel setting. However, in the pre-docetaxel setting, we find median OS improved by 5.9 months and median PFS improved by 8.3 months for enzalutamide patients. When adjusting for gleason score in a regression model, median OS and median PFS showed greater improvements of 19.2 and 14.6 months respectively. Our results suggest that patients that have yet to undergo chemotherapy may benefit from a longer survival time when treated with enzalutamide first-line rather than abiraterone.
Intracortical microelectrodes have the potential to mitigate the effects, treat and understand neurological injuries of the central nervous system. However, these implants cause an inflammatory response of the brain tissue, which leads to a chronic foreign body response and encapsulation of the electrode. Previous work from the our lab has shown success in preventing the blood brain barrier breakdown, oxidative stress markers, and neuronal loss with a one-time administration of resveratrol, an antioxidant used to mitigate the inflammation. In a later study, daily resveratrol intraperitoneal (IP) injections resulted in decreased neurodegeneration but did not reduce neuroinflammation with one dose. This led us to inquire if the mode of drug delivery is causing a peripheral injury in the IP cavity, thus preventing the site of intracortical microelectrode from healing. This study compares repeated IP injections of resveratrol to no treatment at all in order to understand the secondary injury that could be occurring from repeated injections. We hypothesize that animals receiving repeated injections will have reduced healing of neuroinflammation compared to control. Sprague Dawley rats were implanted with silicon, non-functional intracortical microelectrodes for two weeks, divided into two groups: IP resveratrol injections and no injection. Immunohistochemical staining of the cortical tissue was used to examine the permeability of the blood brain barrier (BBB), neuronal viability, microglial/macrophage activation and astrocytic encapsulation. Administration through repeated IP injections increased BBB permeability, astrocytic encapsulation and decreased neuronal loss compared to the control animals. The results from this study suggest the repeated IP injections cause a continuous peripheral injury in the IP cavity. It has been shown that a brain injury cannot heal until a peripheral injury has healed, so, other modes of delivery to treat neuroinflammation are encouraged.
Thermoplastic tooling made by Fused Deposition Modeling (FDM) is used to form custom sheet metal parts in low strain-rate processes. FDM is an additive manufacturing technique that builds parts layer by layer, where each layer is made from parallel polymer filaments such as polyetherimide (PEI). Unlike traditional sheet metal forming tools, FDM tools deflect under applied loads and produce imprecise parts. Therefore, accommodating for the deflection would improve the dimensional accuracy of parts produced with FDM tools and expand the forming capabilities to parts with stricter tolerance requirements. However, knowledge of the mechanics of FDM materials is still in development. The mechanical response is anisotropic and changes with the mesostructure of the FDM parts, which is controlled by a large number of 3D printing variables. This study focuses on the air gap and raster angle variables. The air gap controls the density of the part and is shown to have a significant impact on the mechanical response and the amount of anisotropy observed. The raster angle rotates each layer with respect to the layer beneath it, introduces a rotation component to the anisotropic compliance tensor, and changes the interfacial area between layers. Testing revealed that the mechanical response was non-linear and thus required an algorithm to produce a consistent secant modulus for comparing combinations of 3D printing variables, also called a build style. The algorithm used is a change point detection method for the generalized linear model.
Animals as models for robot mobility and autonomy: Crawling, walking, running, climbing and flying

**Abstract**

We incorporate neuromechanical principles of locomotion and autonomy into robot designs. A robot that captures the leg designs important for animal locomotion, for example, will be extremely agile and suitable for many missions. However, there remain some technical issues that must be solved before a robot with the intricate leg designs and energy efficiency of an animal can be deployed. Therefore, we are using multiple complementary approaches to develop mobile robots. In one approach the fundamental principles of animal (e.g. cockroach) locomotion are applied using existing technologies and in a simplified manner. Their motor control is also simplified and the agility of these vehicles makes them suitable for many applications such as amphibious operations and search and rescue. This abstracted approach has also been used to develop a small fixed-wing vehicle called MALV (micro air and land vehicle) that flies, lands and crawls. Using a more direct approach we are developing a flapping-wing robot with moth-like wings. We have also developed a number of robots with multi-segmented legs mirroring those of animals. For these robots, we are developing synthetic nervous systems for their control based upon animal neurobiology. We are also developing structurally soft worm-like robots, which crawl via continuous waves, for pipe inspection and, when made compact, within the body. Robots with a human in the loop for basic control decisions are limited in their movements in complex terrain because of sparse sensory data and limited communications. Some autonomy is essential for their agility. Insect neurobiology and behavioral experiments are being used to develop decision making strategies. Our autonomous Snowmower, benefits from a distributed control architecture similar to that found in animals and will eventually implement an animal-like brain. In still another approach, teaming with the EMAE biofab group, small robots are being developed using organic materials.
The purpose of this study is to quantitatively analyze the improved radiosensitivity of prostate cancer cells to ionizing radiation (IR) when radiation treatment is combined with androgen deprivation therapy (ADT). The double strand breaks (DSBs) induced by ionizing radiation are repaired primarily by non-homologous end joining (NHEJ). It is reported in the literature that NHEJ is impaired after ADT, which then results in increased radiosensitivity and better IR treatment outcomes in prostate cancer. In this study, we have used our previously developed models for NHEJ repair of DSBs under IR treatment and IR + ADT combination treatment conditions to determine how the combination treatment results in better outcomes. We have modeled the effect of multiple doses of IR that are delivered 24 hours apart to mimic the conventional, fractionated radiation treatment. The analysis results showed that the DSBs accumulate more in the case of combined treatment with ADT compared to faster and more efficient repair when only IR is applied. We have used the experimental data on relative cell numbers and relative sub-G1 cell numbers from the literature to determine the difference in the levels of DSBs that lead to cell death differences between the two treatment strategies. The literature data also shows that there is patient response variability to ADT in terms of the reduction in the levels of Ku70/80, which is the first NHEJ protein complex that is recruited to DSBs. We have modeled this patient variability in our models by introducing variability to Ku70/80 protein concentrations used in the simulations. Our simulation results agree with the observation from clinical data that lower concentration levels of Ku70/80 lead to better radiosensitization.
The Ethics of Adolescent LARC Use and Access: An Analysis of Reproductive Autonomy, Provider Obligations, and State Policies

Unintended pregnancy in adolescents result in increased maternal and neonatal morbidity and mortality, worsened psychosocial outcomes, diminished ability to pursue educational and career goals, and cost the national health system $9.4 billion per year. Long-acting reversible contraception (LARC), which includes both intrauterine devices and subcutaneous implants, have been a major factor in decreasing the rate of unintended teenage pregnancies in the United States. The Centers for Disease Control and Prevention have labelled LARCs tier-one contraception because they are the safest and most effective forms available. Unfortunately, rates of LARC use by adolescents are low due to intrinsic issues (lack of knowledge, concern over the invasiveness) as well as extrinsic issues (parental consent laws, financial barriers, and lack of access). We argue that it is fundamentally unjust that many LARC policies and laws exclusively afford only those adolescents with the luxury of parental approval the ability to protect themselves from the risks associated with teenage pregnancy. We contend that there do not exist any actual or theoretical harms compelling enough to override American adolescents’ vital need for safe and effective contraception. Ultimately, we recommend improved knowledge and training in LARC for healthcare providers as well as revised healthcare policies that are evidence-based and public-health focused.
Characterizing the clonal structure of a tumor is valuable for understanding the biology of the disease. Recent advances in single-cell DNA sequencing (scDNAseq) technologies enable the characterization of clonal architecture in heterogeneous cell populations. Studies of clonal detection with scDNAseq data usually consider a trade-off between the number of cells assayed and sequencing depth per cell. Our study aimed to provide a guideline for determining the optimal number of cells and sequencing depth needed to detect subpopulations in single cell studies for clonal detection. We performed simulations based on previously published scDNAseq data from two patients with childhood acute lymphoblastic leukemia. Samples were simulated with a wide variety of number of cells and sequencing depths. A Bernoulli mixture model was applied to identify cell clusters. Simulation was repeated 5 times to reduce the variations introduced by sampling strategies. We counted the average number of clusters and misclassification rates for each sample. In each of the 5 simulations, we simulated 49,800 samples from two patients. Our results suggested that under fixed sequencing budget, more cells with lower depth yield correct number of clusters and low misclassification rate. For example, the original data from one patient contained 255 single cells with average sequencing depth 388x. At 40% of the original budget, we compared a range of designs, from sequencing 255 cells at 40% of the original depth to 100 cells at 100% of the original depth. In general, more cells led to better influence about the clusters. Samples with at least 200 cells and average sequencing depth higher than 100x, had a large probability to achieve correct number of clusters and the misclassification rates for these samples were lower than 5%. When the sequencing depth was lower than 100x, increasing the cell count was not able to improve identification of subpopulations.
**Abstract**

Single crystal structures have been determined for the cofacial \(\text{?}-\text{oxo} \) silicon-silicon phthalocyanine dimers, (CH\(_3\))\(_3\)SiO[SiPcO]2Si(CH\(_3\))\(_3\), (C\(_2\)H\(_5\))\(_3\)SiO[SiPcO]2Si(C\(_2\)H\(_5\))\(_3\), (C\(_3\)H\(_7\))\(_3\)SiO[SiPcO]2Si(C\(_3\)H\(_7\))\(_3\), (C\(_3\)H\(_7\))(CH\(_3\))\(_2\)SiO[SiPcO]2Si(CH\(_3\))\(_2\)(C\(_3\)H\(_7\)), ((CH\(_3\))\(_2\)CHCH\(_2\))\(_3\)SiO[SiPcO]2Si((CH\(_2\)CH(CH\(_3\)))\(_2\))\(_3\), ((CH\(_3\))\(_2\)CHC(CH\(_3\)))\(_2\)(CH\(_3\))\(_2\)SiO[SiPcO]2Si(CH\(_3\))\(_2\), (((CH\(_3\))\(_2\)CCH(CH\(_3\)))\(_2\))\(_2\)(CH\(_3\))\(_3\), (C\(_2\)H\(_5\))\(_3\)SiO[SiPcO][SiPcO]2Si(C\(_2\)H\(_5\))\(_3\), (C\(_3\)H\(_7\))\(_3\)SiO[SiPcO][SiPcO]2Si(C\(_3\)H\(_7\))\(_3\), (C\(_4\)H\(_9\))\(_3\)SiO[SiPcO][SiPcO]2Si(C\(_4\)H\(_9\))\(_3\), ((CH\(_3\))\(_2\)CHCH\(_2\))\(_3\)SiO[SiPcO][SiPcO]2Si(C\(_18\)H\(_37\))\(_3\) and (C\(_6\)H\(_5\))\(_3\)SiO[SiPcO][SiPcO]2Si(C\(_6\)H\(_5\))\(_3\), for the \(\text{?}-\text{oxo} \) silicon-germanium phthalocyanine bimetallic dimers, (C\(_6\)H\(_13\))\(_3\)SiO[SiGePcO]Si(C\(_6\)H\(_5\))\(_3\) and (C\(_6\)H\(_13\))\(_3\)SiO[SiGePcO]Si(C\(_6\)H\(_5\))\(_3\), and for \(\text{?}-\text{oxo} \) germanium-germanium phthalocyanine dimers, (C\(_2\)H\(_5\))\(_3\)SiO[GePcO][GePcO]2Si(C\(_2\)H\(_5\))\(_3\), (C\(_4\)H\(_9\))\(_3\)SiO[GePcO][GePcO]2Si(C\(_4\)H\(_9\))\(_3\), ((CH\(_3\))\(_2\)CHCH\(_2\))[GePcO][GePcO]2Si(CH\(_2\)CH(CH\(_3\)))\(_2\)), (C\(_6\)H\(_13\))\(_3\)SiO[GePcO][GePcO]2Si(C\(_6\)H\(_13\))\(_3\) and (C\(_6\)H\(_5\))\(_3\)SiO[GePcO][GePcO]2Si(C\(_6\)H\(_5\))\(_3\). The torsion angles between the two cofacial phthalocyanine rings in these dimers is not the intuitively expected angle of 45 degrees, but rather these torsion angles cluster at 17 and 37 degrees. DFT and AIM calculations support the concept that long, directional interactions (LDIs) are present between the two cofacial phthalocyanine rings.
Exercise to lower cardiovascular disease risk is highly beneficial for persons with spinal cord injury (SCI)\textsuperscript{1,2}. Oxygen consumption (VO2) is well accepted as the most accurate measurement of aerobic exercise intensity\textsuperscript{3, 4}. For SCI persons, the American College of Sports Medicine (ACSM) recommends exercise at a minimum intensity of 50-80\% peakVO2 to improve physical fitness\textsuperscript{5,6}. Previous studies evaluated VO2 in SCI during stationary cycling with neural stimulation and other exercises\textsuperscript{7}. However, the peakVO2 in stimulation-assisted cycling with implanted pulse generators on a recumbent trike that offers recreational, overground use, unlike commercially available surface stimulation-driven, stationary cycles, has not been investigated. The purpose of this study is to evaluate exercise intensity in SCI during implant-driven cycling on a recumbent trike. We hypothesized that such exercise intensity would meet or exceed authoritative recommendations and exceed that of surface-stimulated, stationary cycling. To address this hypothesis, 3 SCI persons were evaluated for VO2 during implant-driven cycling on the Catrike\textsuperscript{700}. VO2 was measured with the K4b2 system during five minutes of rest, followed by cycling on a trainer until fatigue, followed by five minutes of recovery, as tolerated. The peakVO2s obtained were 21.8ml/min/kg, 15.5ml/min/kg, and 17.4ml/min/kg, corresponding with 62\%, 44\%, 50\%, respectively, of predicted peakVO2 based on a method used by Asselin et. al\textsuperscript{8}. The implant-driven Catrike\textsuperscript{700} achieved a higher peakVO2 compared to the 14.3ml/min/kg documented for cycling with surface stimulation in a review by Hettinga et. al\textsuperscript{7}. However, one peakVO2 was below ACSM recommendations. More studies are needed to fully evaluate this new modality’s exercise potential. Results thus far suggest it can offer a level of exercise superior to traditional options. Furthermore, the implanted system’s modern design and overground capabilities may provide motivation to exercise.
Stimulating paralyzed trunk muscles can improve seated posture, balance and workspace, stabilize the spine and pelvis and decrease voluntary upper extremity effort required for reaching, standing and stepping. Yet, clinical outcomes are mixed. The purpose of this study was to fully characterize the stimulated responses of paraspinal electrodes as a first step to develop a more repeatable implantation technique. Spinal cord injury subjects (C5-T3; AIS A-C) were recruited from the pool of prior participants in our research programs from 1999 to 2016 with intramuscular (IM) stimulating electrodes implanted bilaterally near the T12/L1 (quadratus lumborum (QL)), L1/L2 (erector spinae (ES)) or L2/L3 (iliopsoas (IL)) spinal nerves. Each electrode was rated by systematically increasing stimulation while recording values at which target muscles were recruited, neighboring muscle activity or reflexes were observed and symptoms of autonomic dysreflexia (AD) were evoked. Responses were rated on a scale of 1 (poor), 2 (acceptable) or 3 (excellent) according to the strength of target muscle contractions, unintended activation of antagonists and prevalence of AD. The average rating for all electrodes was 2.47 (eight excellent, nine acceptable, zero poor), with 12% evoking AD, 51% achieving only moderate strength and 65% recruiting other muscles. Responses varied by subject (two had all electrodes rated acceptable, and two had all-but-one electrodes rated excellent), muscle (QL, ES and IL electrodes had average ratings of 2.29, 2.50 and 3.00) and surgeon (one had all excellent electrode ratings, and three had a nearly even split of excellent and acceptable electrode ratings). Future efforts will add more subjects for statistical significance and address variability in outcomes by standardizing the implantation procedure and relating the clinical outcomes to anatomical location.
Evidence shows that many cancers include populations of cancer initiating cells (CICs), believed to contribute to drug resistance and cancer recurrence. These cells form orospheres (spheroids) in vitro when grown in suspension due to contact-independent survival and proliferation. Despite extensive characterization in other cancers, the suitability for orospheres as an in vitro model for head and neck cancers remains poorly characterized. We have shown that human beta-defensin 3 (hBD-3), an epithelial cell-derived immune molecule, is overexpressed in HNSCCs and is indicative of a microenvironment favorable for tumor growth. hBD-3 can be detected extracellularly, while other CIC markers are only identified via biopsy. Thus hBD-3 is a promising biomarker for CIC identification via noninvasive procedures.

We compared orosphere formation and gene expression in HNSCC cells grown in monolayer or suspension when treated with clinically-used drugs. We hypothesize that the drugs will decrease expression of CIC markers and orosphere formation.

Methods: Two cell lines were grown in suspension and monolayer. Cells were treated with epidermal growth factor, cetuximab, or cisplatin. Orosphere formation was microphotographed for 7 days and compared to controls. All cells were analyzed by qPCR for expression of hBD-3 and BMI-1 with GAPDH as the housekeeping control.

Results/Conclusion: Orospheres were successfully grown. Cetuximab treatment resulted in smaller spheroids than cisplatin. Differences in orosphere size in response to various treatments give insight into how drugs affect CICs. Cisplatin, a known genotoxic drug, failed to inhibit hBD-3 expression, in contrast to cetuximab. The role of these drugs will be further validated by analyzing protein levels of hBD-3 and BMI-1 in monolayer and orosphere cultures. Our data suggests that upon further study, hBD-3 has the potential to be a possible prognostic biomarker following therapy.
**Abstract**

Background: Aggressiveness of care at end-of-life is an important end-of-life quality indicator and has been linked with worse quality of life for the patient and worse bereavement adjustment for caregivers. African Americans (AA) participate in more aggressive treatment at end-of-life (Sanders, Robinson, Block, 2016) yet little work has examined the role that end-of-life values of care and religiosity play in their treatment decisions. The goal of this presentation is to examine similarities and differences between AAs and Caucasians regarding end of life values.

Objectives: The goal is to examine similarities and differences between AAs and Caucasians regarding end-of-life values of care, goals of care, and religiosity for patients with Stage IV GI and lung cancer.

Methods: This was a longitudinal descriptive correlational study. Adult patients who met eligibility criteria were enrolled and interviewed at that time. The interview focused on clinical and demographic variables as well as end-of-life preferences, goals of care, and evaluation of treatment effectiveness. Patients were given a brief follow-up interview every 3 months that focused upon evaluation of treatment effectiveness and goals of care until death or end of the study period (15 months).

Results: Of the 201 participants who provided data for this study, 54 were AA. Statistically significant differences between AA and Caucasian patients were found in their levels of religiosity (p=.001), their wish to live as long as possible (p=.001), and the degree to which spirituality/religiosity (p<.001) influenced treatment decisions. AAs reported greater importance of these EOL values. No differences were found in the value of wishing to not be a burden to family, wishes of other family members in their EOL preferences, and the wish to have a dignified death.

Conclusion: The literature recommends viewing differences that contribute to end-of-life treatment (Nickolich, El-Jawahri, Temel, LeBlanc, 2016). Research should be intended to look at these components separately and see how they form into relationships that strongly impact how decisions are made.
Distant metastasis is responsible for 90% of cancer related deaths. There is an urgent clinical need for therapies that target metastasis, particularly in aggressive pediatric cancers like osteosarcoma. The majority of osteosarcoma patients (~70%) are cured with standard therapy. It is known that without chemotherapy, most patients presenting with only clinically detectable primary tumors will develop metastases – indicating that they had micrometastases at the time of presentation. In the minority of patients that present with clinically overt metastases, outcomes are far worse. This illustrates an unmet clinical need for the development of targeted anti-metastatic therapies. There is a similar need in other types of cancer. Preclinical cancer drug screens are typically completed in vitro, a setting that does not recapitulate the microenvironmental conditions of metastasis. To overcome these limitations, we adapted an ex vivo pulmonary metastasis assay (PuMA) for drug screening. This system preserves the 3D architecture of the lung and enables monitoring of metastatic cell outgrowth in real-time. We recently showed that epigenetic alterations at gene enhancer elements endow osteosarcoma cells with the capacity to colonize and grow in the lung microenvironment. We leveraged these findings and the PuMA assay to test several epigenetic-related bioactive compounds that either inhibit initial colonization of the lung or instigate regression once metastatic cell outgrowth has occurred. We identified several compounds that significantly reduce metastatic cell proliferation in the lung within 14 days of treatment compared to controls. Of particular interest, the CDK7 inhibitor BS-181 was found to both inhibit initial growth and induce metastatic cell regression with minimal toxicity. Our results indicate that the PuMA system can be effectively leveraged for identification of anti-metastatic compounds.
In an environment where energy-conscious building design has become more common, and inexpensive products with claimed energy-saving benefits abound, it is extremely important to more deeply understand the science behind building energy efficiency. What works, why, and what level of detail is necessary to adequately analyze the building product or design problem at hand? In some instances, simple hand calculations are more than sufficient, but in others, highly-detailed computational fluid dynamics (CFD) might be required. Through a series of analytical and computational case studies, this work analyzes questions that span that spectrum. At the extremes, miracle "insulating paint" products are shown to be inadequate using even the simplest level of analysis, while radiative effects of interior surfaces are shown with CFD to vary significantly based on the circumstance. In between, linear system models are used to capture important transient behavior from CFD simulations (at significantly reduced computational expense), and provide insight into innovative control strategies and optimization of construction materials to minimize energy consumption in buildings during the design and operation stages.
Mammalian target of rapamycin (mTOR) pathway regulates cell growth by coordinating energy and nutrient signals with growth factor. Two different complexes are known for mTOR protein kinase, mTORC2 complex; Rictor (rapamycin-insensitive companion of mTOR) is vital in the activation of Akt/PKB by phosphorylating at Ser-473. Rictor is overexpressed in prostate cancer cells. Rapamycin is known inhibitor of mTOR, however, it is not specific for mTORC2 complex. Diosmetin (5,7’-Trihydroxy-4’-methoxyflavone), a naturally occurring flavonoid, has anti-mutagenic effects and represented chemo-preventive effects on prostate cancer cells. We have shown that diosmetin induces apoptosis and inhibits cell growth in human prostate carcinoma LNCaP and PC-3 cell lines. Growth factors (IGF-1, IL-6) treatment to LNCaP and PC-3 cells modulated Rictor expression, which subsequently induced p-Akt expression. Moreover, diosmetin treatment to these cells inhibited Rictor and its phosphorylation at Thr-1135. Dose response treatment to LNCaP and PC-3 cells inhibited cell growth, survival and promoted apoptosis by down regulating the essential molecules of viz., c-Myc, X-Linked Inhibitor of Apoptosis (XIAP), and Survivin. Next, we implanted luciferase tagged PC-3 cells into nude mice ventral prostate and fed these mice with diosmetin doses (20, 50 microgram/animal/day). After 8 weeks of diosmetin feeding we observed dose response reduction in tumor volume comparing with control mice. We observed decreased tumor luciferase activity in diosmetin fed mice. Isolated tumors represented, diosmetin dose response decreased expressions of Rictor and Rictor phosphorylation (Thr1135), p-Akt (Ser-473), and p-PKC-alpha (Ser-657). Moreover, diosmetin fed mice represented increased cleaved caspase-9 expression, which induces apoptosis. Results suggest that diosmetin has potential to inhibit prostate tumor growth in dose response fashion and can be developed as an effective antitumor agent for prostate cancer.
Social media has had an impact on how children and adolescents interact with one another. Approximately 92% of Americans teens use the Internet and it’s reported that 24% of teens go online “almost constantly”. Furthermore, according to data obtained, 81% of teens in America use social media, 50% of which use it daily and 22% check it more than 10 times a day. While there have been many benefits with social media, cyberbullying has arose as potential harm, especially on the mental health of our children and adolescent population.

About 20% of students between 11-18 years old had reported being both a cyberbully and a victim at some point in their lifetime. Victims of cyberbullying have reported symptoms of poor self-confidence, uneasiness, feeling withdrawn, lower mood and overall anxiety. Studies have also shown that victims report poorer academic scores, higher risk of substance abuse and higher rate of suicide thoughts. Data also suggests that victims of cyberbullying have higher incidence of suicidal ideations than even traditional bullying. Finally, there is emerging research that suggests that collaborative care models with inclusion of students, school faculty, families and mental health professionals is currently the best suggested approach to managing cyberbullying.

In our presentation, we will be presenting data obtained from 78 articles which we obtained from Pubmed using the search terms, “Cyberbullying”, “children”, and “adolescents”, via slide presentation. We will be educating the audience on what cyberbullying is, how it compares to traditional bullying, discuss the impact it has on mental health on our child and adolescent population and their families, challenges of cyberbullying and the role mental health professionals play in addressing and managing cyberbullying.
Abstract
The engineering properties of clayey soils, including fluid permeability, erosion resistance and cohesive strength, are quite different from those of non-cohesive soils. This is mainly due to their platy particle shapes and the surrounding diffuse double layer structure. By using the Atomic Force Microscopy (AFM), the surface topography and the interaction force between the silicon dioxide tip and the kaolinite/montmorillonite clay minerals have been measured in the 1.0 mM NaCl solution at neutral pH. From this, the surface potential of the clay minerals is determined by mathematical regression analyses using the DLVO model. The length/thickness ratio of kaolinite and montmorillonite particles measured range from 8.0 to 15.0. The surface potential and surface charge density vary with particles. The average surface potential of montmorillonite is -62.7 mV, and the average surface potential of kaolinite is -40.9 mV. The measured results help to understand the clay sediment formation, and will be used to develop interparticle force model to simulate sediment transport during erosion process.
Abstract

Diosmetin (5,7-Trihydroxy-4'-methoxyflavone) is a naturally occurring flavonoid present in citrus plants, has chemopreventive effects on prostate cancer. In present study, we observed diosmetin as an effective inducer of apoptosis and inhibitor of cell growth in human prostate carcinoma LNCaP (androgen-responsive) and PC-3 (androgen-refractory). However, growth of normal prostate epithelial cells; RWPE1 cells, were not inhibited after diosmetin treatment. The serine/threonine protein kinase, mTOR (mammalian target of rapamycin) is a regulator of cell growth, proliferation, motility and survival having two distinct complexes: mTOR complex 1 (mTORC1) and mTOR complex II (mTORC2). Component Rictor (rapamycin-insensitive companion of mTOR) of mTORC2 plays a vital role in the activation of Akt/PKB by phosphorylating at Ser-473. In prostate cancer cells, the induced expression of Rictor by IL-6 (cytokine) and IGF-1 (growth factors) inhibited by diosmetin (20µM) treatment. Diosmetin treatment inhibited Rictor nuclear localization, inhibiting phospho-Akt (Ser-473) and increased the nuclear presence of FOXO3a (Forkhead box O3) protein. The treatment also inhibited downstream of mTOR pathway; p70S6 kinase, which promotes cell growth and survival. Additionally, the diosmetin downregulated Cyclin D1, cdk2 and cdk4 and increasing KIP1/p27 and INK4a/p16. Moreover, diosmetin treatment altered mechanisms of cell survival by down regulating the essential molecules of viz., c-Myc, X-Linked Inhibitor of Apoptosis (XIAP), and Survivin. The present study demonstrates, LNCaP and PC-3 cells after diosmetin treatment inhibited Rictor levels, which in turn altered Akt inhibited cell cycle progression and induced apoptosis.
The wind shear model describes the variation of wind speed with elevation, which is commonly used to estimate the wind speed at wind turbine hub height based on monitored wind speed data. Structural design specification such as ASCE7-05 provides wind shear model parameters associated with different ground topological conditions. The recommended values, however, are intended for estimation of wind load on structural safety, which might not meet the need for wind energy production assessment. This paper describes the work to collected site-specific wind data which can directly calibrate the parameters of the wind shear model for both onshore and offshore sites near Lake Erie. This provides an opportunity to directly evaluate the accuracy of recommended wind shear model parameters for wind speed estimation for wind energy production purpose. The terrain effects are evaluated by using monitoring data to calibrate the model parameters for both power law and logarithmic law wind shear models, i.e. wind shear coefficient and roughness length. Seasonal wind data shows appreciable seasonal variations of the calibrated model parameters, which is contradictory to the constant value currently used. Four scenarios were carried out to compare the wind assessment accuracy between different methods and power law wind shear model with calibrated wind shear coefficient provide the most accurate estimation of wind speed. The analyses also indicate that the use of wind shear model parameters by a specification such as ASCE7-05 might underestimate the wind energy output. Site-specific calibration of wind shear model could further improve the accuracy in wind energy assessment by considering the site condition and the seasonal variabilities.
Amphetamine Induced Delusional Parasitosis?

Method:
We report a case of a 32 year old female who was admitted to our psychiatry unit with bizarre behavior and delusions of her house being infested by bugs. She constantly visited dermatologists with complaints of lesions on her skin and was treated with multiple medications for it. She moved out from her apartment and her symptoms worsened to the point that she was having paranoid delusions toward her sister. Many stressors were influencing her presentation and she was self-medicating herself with Adderall.

Results:
Patient was started on Abilify and Dermatology was consulted. There was no evidence of infestation on the samples she provided, what she alleged to be insects was determined to be dead skin, fibers, and dried nasal mucus. She improved briefly but relapsed on Adderrall that she got from the street and was demanding Straterra. On a follow up appointment she was reported to have complaints of papules and having had noticed bugs.

Conclusion:
Our case suggests that treatment with Aripiprazole may be relatively efficacious in a patient with delusions of being infested with parasites. Although this patient has many psychosocial stressors, she did not have prominent neurovegetative symptoms of a mood disorder neither negative symptoms or executive dysfunction that could explain a primary psychotic disorder. Of note, she had been abusing amphetamines and the emergence of symptoms corresponds with when she started abusing them. Increased levels of dopamine in the striatum could be an explanation of patient's presentation supported by temporary improvement while discontinuation of stimulants while inpatient with concomitant deterioration when resuming them and also by treatment with dopamine agonists. So we would want to emphasize that secondary delusional parasitosis due to abuse of amphetamines is possibly managed by treating with aripiprazole.
Hydraulic conductivity and soil-water retention are two critical soil properties describing the fluid flow of unsaturated soils. It is time consuming and labor intensive to determine these two parameters experimentally. In this paper, a microstructure-based model is developed to describe the unsaturated soils in three phases based on the volumetric content of each phase. The model is converted into a finite element model. The hydraulic properties of each soil phase (soil particle, water, and air) are applied randomly based on the microscopic structures. Darcy’s law is used in the simulation to determine the hydraulic conductivity function. Intrinsic permeability of each phase of soils is calibrated from dry and saturated conditions from the experiments. Mualem’s equation is applied to fit the pore size parameter, and soil-water characteristic curve is predicted from Genuchten’s equation. The simulation results are compared with the experimental results obtained from the literature for four soils and the simulation results agree well with the experimental measurements. Overall, this study offers a new modeling approach to predict the hydraulic conductivity function and soil-water characteristic curve, and provides an inexpensive and efficient way to test the unsaturated soil properties in engineering practice.
Some of the foremost unanswered questions in the field of cosmology revolve around the mysterious, poorly-understood constituents of the Universe: dark energy and dark matter. To understand these phenomena, theoretical models are developed and subsequently tested by comparing them to astronomical observations. Due to the complexity of theoretical models attempting to describe the Universe – and the complexity of structure in the Universe itself – predictions for what the Universe looks like are made by performing numerical calculations. However, these calculations typically rely upon a Newtonian model of gravity, fundamentally limiting the accuracy with which predictions can be made. This work begins to address this assumption by performing simulations using Einstein’s theory of general relativity, exploring the ways in which approximate models of gravity may affect our understanding of the Universe.
In this study, a guest carrier which consists of magnetic-directed hydrogel particles with NIR-light triggered guest-release property is fabricated. NIR responsive polypyrrole (PPy) nanoparticles associate with temperature sensitive poly(N-isopropylacrylamide) (PNIPAM), which can induce the release of encapsulated drug when shining NIR light onto these gel beads, are utilized to functionalize this hydrogel system. Additionally, with iron-oxide-particles-crosslinking Polyvinyl alcohol (PVA) frame, these particles show an obvious decreased release rate with a surrounding magnetic field when moving in fluid. Moreover, being oriented by the magnetic field enables particles to arrive their destination directly and efficiently.
Many studies have shown that understanding the ability to identify and regulate emotions is an important factor in relation to the development of psychological disorders. Children learn to understand and regulate their emotions in their early age and it is important that they maintain this ability to protect themselves from developing psychological disorders. In this research, I will focus on two questions. First, do children with high or low depressive symptoms have bias response for sadness? And second, how do the findings differ when children have a healthy/non-healthy relationship with their caregivers. I will use a data collected in the FREY lab (Relationships, Emotion, and Family Lab), Emotional Go-No-Go Task, on adolescent girls. The data suggest that kids with high depressive symptoms have bias response for sadness, especially when they do not have a good relationship with their caregivers.
The question of whether the universe is multiply connected is an important one for understanding the origins of the universe. Previous topology-specific searches for possible non-trivial topology of the universe have mistakenly considered only specific cases of the allowed fundamental domains of those topologies. For example, the fundamental domain of a homogeneous space with the topology of the simple three-torus need not be a right rectangular prism, but only a parallelepiped. We present our progress toward performing a search over the full parameter space of possible observer locations and orientations in the parameter space of all possible configurations (side lengths and angles) of parallelepiped fundamental domains of a universe with the topology of a three-torus. By solving the Helmholtz equation for the fundamental domains, we can obtain the characteristic spectrum of each and build an angular correlation matrix for its eigenmodes. We are preparing to search the full twelve-dimensional parameter space of observers and fundamental domains for the point that maximizes the log-likelihood that the angular correlation matrix of the Cosmic Microwave Background temperature data map matches the expectation. Our search for universal topology generalizes earlier searches that considered a reduced six-dimensional parameter space.
**Title**: Cladding of H13 Aluminum Forging Dies with Heat Resistant Alloys for Enhanced Die Life

**Elevator Speech**
Hot forging dies are high stress components that can be a large cost driver in the manufacturing process. These components often fail by thermal fatigue, however cladding of these tools with a more heat resistant material has the potential to greatly improve useful life and save money.

**Abstract**
Forging dies are subjected to extreme conditions involving high temperatures, usually in the range of 300-500°C, large cyclic loads, and repeated impacts. These dies are commonly made from H13, a hot work tool steel known for its combination of good mechanical properties, high temperature stability, and large volume hardenability. Despite the favorable properties of H13 forging dies still experience failures in-use, primarily by thermal fatigue, also known as heat checking. This failure mode is characterized by as a network of fine cracks that form on the die surface. To counteract this low cycle fatigue mechanism a more heat resistant alloy, typically a nickel or cobalt-based alloy, can be deposited on the surface. Direct Metal Deposition of powder and laser hot-wire (LHW) cladding, a free-form additive manufacturing technique that allows metals to be deposited on a substrate at a high rate were employed as deposition methods. Preliminary results of this investigation are highlighted.
The liver is the 6th most common cancer site worldwide and final destination for many metastatic cancers from external tissues. The goal of our project is to develop a clinically relevant model of the human liver both to study aspects of cancer disease AND to screen anticancer treatments for personalized medicine and drug development. The patient-derived xenograft (PDX) is a strategy to simulate the patient by transplanting fragments of a tumor into a mouse surrogate, and has shown relative success when translating effective model-tested drugs back to the patient. Unfortunately, the PDX model has notable weaknesses, in particular a low take rate prolonging engraftment past a practical period for clinical use. We are now developing a tissue engineering model of the liver that recapitulates the liver microenvironment for an immediate goal of increasing engraftment of the tumor biopsy in an animal model.

We make use of a detergent based approach for removing cells from tissue to create a hospitable environment to reinforce the authentic behavior of tumor cells. Using nuclear staining as a surrogate, we are able to demonstrate complete decellularization of porcine livers to an acellular scaffold for 2D and 3D culture. We have since devised a series of experiments to test the possibility of the acellular liver matrix to preserve healthy liver cell behavior including cell morphology, albumin secretion, metabolic cytochrome activity, and cell viability. These cell features of viability and metabolic activity are typically lost when normal cells are plated in culture. In our preliminary data, we confirm that human liver-derived cells (primary and cell lines) can grow on acellular matrix. We now present supporting data that acellular liver matrix reinforces aspects of natural cell behavior. Our ultimate goal will be to progress this study to the generation of a synthetic material to host tumor biopsies to grow as if the tumor was in the human body.

Elevator Speech
A better understanding of liver cancer and how it responds to drugs can lead to a higher rate of effective drug development, more effective disease treatment, and better care for patients.
**Title**: SLIME: Scatter Labeled Imaging of Microvasculature in Excised Tissue Using Optical Coherence Tomography

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**Elevator Speech**: The presented work provides an easy, fast and inexpensive way for researchers to study organ level microvasculature organization in tissue volumes. The new 3D microvasculature mapping methods is more cost and time effective compared to previous methods, which enables 3 dimensional high-throughput evaluation and quantification of disease state microvasculature with a large number of samples.

**Key Words**: Microvasculature, Angiography, Vasculature Imaging, Optical Clearing, OCT

**Abstract**: Abnormal coronary development causes various health problems. However, coronary development remains one of the highly neglected areas in developmental cardiology due to limited technology. Currently, there is not a robust method available to map the microvasculature throughout the entire embryonic heart in 3D. This is a challenging task because it requires both micron level resolution over a large field of view and sufficient imaging depth. Such requirements are achievable with the advanced imaging modalities such as synchrotron-based micro-CT. However, most of the current methods are not cost effective, so only a small number of samples could be studied at a time with limited budget. To address this problem, we present an optical coherence tomography-based imaging procedure that enables 3D mapping of the coronary microvasculature in small volumes of tissues. In brief, the target tissue samples were perfused with titanium dioxide based contrast agent to label the microvasculature. Then, the tissues were made transparent with optical clearing, a chemical treatment that reduces light scattering in biological specimen. The titanium dioxide particles remaining in the coronaries provided a strong OCT signal, while the rest of the tissue structures became relatively transparent. Using this technique, we are able to investigate coronary morphologies in different disease models. We also applied this method to imaging various types of tissues in small animals including brains, limb muscles, kidneys, etc, and obtained promising results from all of the tissues.
One of the most striking predictions of the Big Bang theory is what is known as the cosmic microwave background radiation (CMB). This radiation consists of relic photons from the early stages of the Universe that permeate all of space, having traveled through the universe for most of cosmic history. The CMB photons have a thermal energy distribution with a nearly uniform temperature of around 2.7 kelvin. Although nearly perfectly isotropic, this microwave radiation we observe has tiny ripples in it as one looks at the sky in different directions. These fluctuations in temperature carry information about the distribution of the contents of the Universe, from the very early times when the Universe’s energy was mostly due to radiation to current times where dark energy drives the expansion. First convincingly detected in 1964 by Arno Penzias and Robert Wilson, the CMB has since been observed with increasing precision. The data obtained from the CMB has been used to greatly expand our knowledge of the Universe and also can be considered as an incredibly successful prediction of the standard model of cosmology, Lambda Cold Dark Matter (LCDM). However, despite its remarkable overall concordance with the standard cosmological model, the CMB has features that are highly unlikely, given our current understanding of the Universe. These so-called statistical anomalies could be a coincidence, or they could be a window into unknown physics. Therefore, it is of great importance to make predictions based on these anomalies so that we can further our understanding of the Universe, its structures and its history.
The Standard Model of particle physics explains all experiments on the interactions of fundamental particles that we have ever performed. At its core, it is a theory of interacting quantum fields describing the fundamental interactions among the elementary particles such as electrons, quarks and photons. The interactions in the Standard Model are governed and constrained by principles of symmetry, which dictate the possible interactions among the fundamental particles. Symmetries in quantum field theories are often conveniently expressed in relations called Ward-Takahashi Identities. These identities relate to one another the rates of two or more different physical processes, such as the scattering rate of one collection of fundamental particles and the scattering rate of a different collection of fundamentals particles.

In this study, we work with a simplified version of the sector of the Standard Model that relates to the Higgs boson, which is called the Abelian Higgs Model, and show that there is a new symmetry relation that the particles have to obey. Unlike the usual symmetries of the Standard Model, the symmetry is not realised on the level of the Lagrangian of the model -- the mathematical object that encapsulates the possible interactions of the model’s constituents. That is because by mathematical necessity the Lagrangian includes fields that are not actually physical degrees of freedom. The symmetry appears only when one limits oneself to studying the interactions among the physical states of the theory. We construct two sequences of Ward-Takahashi identities corresponding to this symmetry and use them to constrain the possible interactions that can happen in the theory. This procedure greatly simplifies the form of available interactions by substituting hard to calculate physical processes with easy to calculate ones.

Finding the symmetry relations that the elementary particles obey deepens our understanding of the fundamental interactions in physics. It also serves to constrain theories in which new particles are hypothesised. The symmetry relations are not limited to the Standard Model and can be extended for Beyond the Standard Model proposals.
Aluminum-doped zinc oxide (AZO) is a low-temperature processed transparent conductive oxide (TCO) made of earth abundant elements; its applications are currently limited by instability to heat, moisture, and acidic conditions. We demonstrate that the application of a surface modifier mitigates AZO degradation, and investigate the interrelation between performance and material composition and morphology. Specifically, we evaluate degradation of bare AZO and APTES (3-aminopropyltriethoxysilane)-modified AZO in response to damp heat (DH) exposure over 1000 h, then demonstrate how surface modification impacts changes in electrical and optical properties, and chemical composition. Hall measurements show that APTES decelerates the electrical properties with no commensurate change in carrier concentration. The % transmission and YI of an ensemble of bare and modified AZO are stable upon DH exposure, but % haze increases slightly for a discrete sample of modified AZO. AFM and OP measurements show a slight increase in surface roughness on both the nanometer and micron length scales. XPS reveal oxygen vacancies are also stable with DH exposure, which, together with transmission and Hall measurements, indicate stable carrier concentrations. Notably, after 1500 h of DH exposure, bare AZO shows signs of catastrophic destruction, whereas the APTES-modified AZO remains chemically stable. This work demonstrates that surface modification slows the bulk degradation of AZO, opening potential avenues for this material to be used as a transparent electrode in the next generation of optoelectronic devices, including extended lifetime photovoltaic applications.
Polymer loops on silica particles and wafers were formed through ring expansion polymerization of \(\beta\)-caprolactone. A surface initiator was synthesized by using epoxy functionalized silane and di-n-butyltin oxide. The initiator was coated on a silica wafer, and \(\beta\)-caprolactone was then polymerized. Several characterization methods will be applied in order to understand the structural-properties relationship. Besides, comparison between polymer loops and polymer brushes will help us enhance synthetic application.
Preference for end-of-life care (EOL) is a complex process, influenced by many factors. A secondary analysis was undertaken to explore agreement among Stage IV cancer patients and their caregivers for EOL preferences, based on caregiver age. It is important for health care providers to understand the decision making process so that adequate support can be given to EOL patients and their loved ones.

Abstract

There is an increasing focus on patients and their loved ones participating in the health care process. Some health care decisions carry great weight, such as choosing end-of-life (EOL) cancer treatment options. These decisions are complex, requiring patients and caregivers to process a great deal of information and weigh risks and benefits. Often there is no medically obvious course of action and the choice comes down to preference. Given the challenging nature of health care decision-making, it is not surprising that research is being conducted by top researchers to determine what factors influence the patient and caregiver decision making process at the EOL.

Preference for care at the EOL is a complex process. Several factors influence decision-making, including religiosity, demographics (age, gender, race, etc.), and outlook on life, among others. An exploratory, descriptive, secondary analysis was undertaken, using data collected by an ongoing NINR funded project currently being conducted by CWRU researchers. The purpose was to determine if there is agreement among Stage IV cancer patients and their caregivers regarding treatment decision-making factors and preferences, based on the caregiver’s age. The literature demonstrates evidence that age can influence preferences for treatment at the EOL among patients. Less is known about the influence of age on caregivers as they participate in their loved ones’ EOL cancer decisions. This analysis compares younger adult caregivers and older adults.

Demographics and characteristics of patients and caregivers are outlined as well. Cancer patients and their loved ones are prominent in the health sciences literature related to decision making. Given the emotional and physical investment that these groups have regarding health care decisions, it is important for care providers to understand how patients and caregivers make decisions so that support can be provided for those who face the EOL.

Funded by NINR: NRO14856
Lack of sensory input in lower limb amputees is critically important in maintaining balance, preventing falls, negotiating uneven terrain, responding to unexpected perturbations, and developing the confidence required for societal participation and public interactions in unfamiliar environments. Despite noteworthy advances in robotic prostheses for lower limb amputees, natural somatosensory feedback from the lost limb has not yet been incorporated in the current prosthetic technologies. Although there have been numerous attempts to provide sensory feedback via tactile or electro-cutaneous sensory substitution, nothing to date has successfully restored natural sensation that is perceived immediately and directly as coming from the phantom limb. In this work, we report the restoration of sensation in two lower limb volunteer amputees. The participants received high-density, flexible, multicontact nerve cuff electrodes around peripheral nerves in their residual limbs. Electrical pulses at safe levels were delivered to the nerves via the cuff electrodes. The electrical stimulation was perceived by participants in the study as sensation in the missing limb. We quantitatively and qualitatively ascertained the quality, intensity, and modality (pressure, touch, and proprioception) as well as the location of the perceived sensation. Stimulation through individual contacts within the nerve cuffs evoked sensations of various modalities (e.g., touch, pressure, movement), at discrete location referred to the missing toes, foot, and ankle, as well as the distal thigh above the knee. Although our initial findings are preliminary, they appear to support the feasibility of our approach to restoring natural sensation to lower limb amputees. In addition, the spatial resolution, variety of modalities and quality of the sensations elicited by our approach are superior to those reported for surface stimulation or sensory substitution techniques such as vibrotactile arrays.
Characterize the properties of the hyperbranched Polyethylenimine(PEI)-block-Polycaprolactone(PCI) with peripheral carbozle groups extended by arms from the hyperbrached core by preparing the Langmuir-Blodgett monolayer. By operating different measurements such as isotherm, deposition, relaxation, and hysteresis, we could characterize the interfacial behaviour of the star-copolymer from different dimensions.
Intimate partner violence (IPV) is a prevalent issue that results in overwhelming physical and mental health consequences. Such mental consequences of IPV include post-traumatic stress disorder, depression, and anxiety. As such, these mental consequences are often attributed to psychological trauma of abuse. However, it is known that majority of victims also suffer from blunt force in the head, neck, and the face area. In this study, we aim to characterize the key associations between IPV and traumatic brain injury (TBI), with a better perspective of understanding the physiological aspects to mental health consequences of IPV victims. To achieve this, we mined accumulated de-identified electronic health record (EHR) data from the Explorys platform and compare health conditions that were prevalent bi-directionally between TBI and IPV. To further solidify this comparison, we also compare these health conditions within the entire female population. Lastly, we ensure that our comparison between TBI and IPV were distinctively unique between those study cohorts, by cross-examining health conditions of IPV among three control cohorts that represent conditions that are non-chronic, acute, non-precursor, and not a significant contributor to TBI. Our analysis consistently reveals that substance abuse is a common bi-directional factor between IPV and TBI. Our results would greatly assist in improving existing screening, diagnostic, and treatment procedures of IPV and potentially TBI patients, especially patients that concurrently suffers from substance abuse, who are also in high risk.
Residential surface soil contamination is often addressed by the use of regulatory guidance values (RGVs) that specify the maximum allowable concentration that may be present in soil without prompting a regulatory response. In the United States, the EPA has developed RGVs for residential sites under its jurisdiction, and many states have developed their own guidance values. The analysis presented was motivated by the variability in the RGVs applied nationally to the top 100 most frequently chemicals. Values are collected among 39 states and the U.S. Environmental Protection Agency (USEPA) including potentially toxic substances of benzidines/aromatic amines, Dioxins and PCBs, hydrocarbons, inorganic substances, nitrosamines/ethers/alcohols, organophosphates and carbamates, pesticides, phenols/phenolic acids, phthalates, radionuclides, and volatile organic compounds. Compared with USEPA, states in average have higher RGVs, where may cause higher risk in health condition.
Novel roofs couple with thermochromic films have been designed for control of solar spectra with potential application as an energy efficiency strategy in built environment. Films incorporated with thermochromic material feature high solar reflectance at higher temperature. In this study, thermochromic films were prepared using hot-pressing technique and additional nano-TiO2 powder was also employed. Energy-efficient roofs were designed by coating smart films on roofing materials (aluminum, wood, plastics, and asphalt concrete). Optical characterization showed that solar reflectance could reach up to 63%, 69%, 49%, and 50% for aluminum, wood, plastics, and asphalt concrete, respectively. Thermal performance measurement found that compared with roofs coated with conventional film, roofs with smart films presented lower surface temperature, i.e., maximum 4°C for wood, 9-10 °C for plastics, and 3.5 °C for asphalt concrete, respectively. These indicate that the novel energy efficiency roofs have presented desirable thermal controlling effect and energy efficiency potential.
The promise of widespread data sharing and “big data” in the era of electronic health records (EHRs) has yet to materialize in a way which allows healthcare providers to make the most informed clinical decisions, researchers to ask the best questions, and clinical trial sponsors to accrue truly representative populations. This vision of ubiquitous data interoperability is seen as an absolute must for most of the large-scale, health transformative efforts such as the Cancer Moonshot and NIH All of Us. As a proposed solution model to addressing these gaps, the Institute for Computational Biology (ICB) (funded by Case Western Reserve University, University Hospitals Cleveland Medical Center, and the Cleveland Clinic), a multi-disciplinary and multi-institutional team of clinicians, researchers, IT professionals, and business leaders in the extremely competitive greater Cleveland healthcare marketplace, propose to create a provider-agnostic clinical data exchange research collaborative called CLEARPATH (CLEveland Area Research Platform for Advancing Translational Healthcare).

Once implemented, CLEARPATH will capture and harmonize heterogeneous electronic health data (EHR, disease registries, biorepositories, image data, etc.) representative of over 75% of the Cleveland area population, providing researchers the ability to do truly significant epidemiological studies, clinical trial sponsors greater probability for representative patient accruals, and healthcare providers new treatment options and population health.

Here we illustrate the process by which the ICB is embarking upon the implementation of CLEARPATH, and discuss the political, regulatory, technological, security, governance, privacy, start-up and sustainability issues involved. Finally, we discuss the underlying data model for CLEARPATH, the OMOP Common Data Model (CDM) 5.1 and the rationale for selecting it over other data models.
A Superhydrophobic and Anticorrosion Coating Based on Thiol-Ene Film Decorated with Graphene Oxide

Do you know that the annual global cost of corrosion is nearly 2.5 trillion dollars and the easiest treatment is coating? My research is using simple spraying method fabricate an anti-corrosion coating using UV-curable thiol-ene solution mixed with graphene oxide.

Abstract

Metal corrosion is a tough problem and costs hundreds of dollars every year. In order to decrease the corrosion, a corrosion resistant superhydrophobic coating was fabricated by using graphene oxide/ ultraviolet-curable thiol-ene solution which consist of pentaerythritol tetra (3-mercaptopropionate), 2,4,6,8-tetramethyl-2,4,6,8-tetravinylcyclotetrasiloxane, and hydrophobic fumed silica nanoparticles. Spray coating and ultraviolet curing was applied in processing procedures, in which the evaporation of the solvent helps the form of roughness in nanoscale size. The coating can prevent the substrate from corrosion by acting as a waterproof layer between water and substrate. After adding graphene oxide, there is an increase of anticorrosion properties and the mechanical properties of the coating since it will form a protective layer in the coating. The coating’s structure and properties were characterized by using electrochemical technique and microscopic surface imaging.
As an important aspect of research in general relativity, numerical relativity employs numerical methods and algorithms to solve the Einstein field equations. We present here a new version of the numerical relativity code, CosmoGRaPH that incorporates adaptive mesh refinement (AMR) using block-structured Berger-Rigoutsos grid generation and supports massive parallelism through the Message Passing Interface (MPI) protocol. CosmoGRaPH evolves spacetime using Baumgarte-Shapiro-Shibata-Nakamura (BSSN) formalism, and accommodates a wide range of sources. The AMR capability and singularity avoiding gauge choices enable the code to evolve non-trivial spacetimes with singularities. We show that CosmoGRaPH is capable of evolving standard space-times, with sources like a Schwarzschild blackhole or a relativistic scalar field, with high efficiency, precision and accuracy.
ATP hydrolysis by UPF1 promotes translation termination at premature stop codons

Premature termination of translation at nonsense codons present within mRNA protein coding regions yields C-terminally truncated polypeptides with potentially deleterious functions to the cell. Nonsense-mediated mRNA decay (NMD) represents a quality control pathway that limits production of these aberrant protein products by recognizing the nonsense-containing mRNA and targeting it to accelerated degradation. How the NMD machinery is able to monitor the relative position of the terminating ribosome to determine it is premature, and communicate this information to the mRNA decay machinery remains unclear. UPF1, the central regulator of NMD, is an RNA helicase whose ATPase activity is essential for NMD, but whose role in this process is unresolved. We show here that in yeast, expression of ATPase-deficient UPF1 results in the accumulation of 3’ mRNA decay fragments harboring ribosomes stalled in the vicinity of the premature termination codon. Moreover, we demonstrate that the ability of UPF1 to impinge upon premature termination requires its RNA binding activity, as well as its ability to associate with NMD co-factors UPF2 and UPF3. Our results reveal a functional interaction between UPF1 and the terminating ribosome that is dependent upon UPF1 ATPase activity and necessary for efficient targeting of NMD substrates to rapid degradation. These data give rise to a refined model of NMD substrate recognition and add to growing evidence that mRNA stability is tightly controlled by events directly impacting mRNA translation.
Behavior change technique taxonomy is important to evaluate how intervention components mirrored the underlying theories of different interventions. Intervention taxonomy has the potential to help behavioral scientists to design more efficient and effective behavioral change interventions.
PURPOSE
More than 25% of global disease burden is attributable to environmental health (EH) risk factors. Institute of Medicine (IOM) reports indicate no or minimal inclusion of EH in US medical school curriculum and made recommendations for EH competency goals. A pilot project was developed to enhance student knowledge and perceptions of EH.

METHODS
This study introduced EH learning objectives into existing problem-based cases for first year medical students at Case Western Reserve University. The authors developed learning objectives based on IOM recommendations for three cases in Block 1 of first year curriculum. Weekly multiple choice and short essay questions were developed by the authors to reinforce learning objectives. EH topics were incorporated as summative short essay questions on final exam. Multiple choice questions were graded on percent of students choosing the correct answer. Short essay and final exam questions were graded on a defined five-point scale developed by the authors. To analyze student perceptions of EH topics, three question survey was distributed to randomized group of students regarding confidence in eliciting an EH history and influence of EH factors on patient health.

RESULTS
184 first year students completed multiple choice and final exam questions. 46 students completed short essay questions. A generalized linear model with binomial distribution adjusted for question variability indicated performance on final exam questions was significantly improved compared to short essay questions. 46 students completed end of block survey. 84.8% reporting EH factors influence patient health. 78.2% reporting confidence in eliciting EH risk factors in patient history.

CONCLUSIONS
Results indicate students gained knowledge about EH topics using the case-based approach and perceived EH to be relevant to patient health. The integration of EH topics into case-based medical school curriculum was successful and should be expanded to the full two-year pre-clinical curriculum.
Achieving Accuracy in U.S. Cancer Incidence Reporting - Assessing a Hashing/Matching Algorithm to Track Out-of-State Cancer Patients

The Surveillance, Epidemiology, and End Results (SEER) Program of the National Cancer Institute (NCI) is an authoritative source of information on cancer incidence and survival in the United States. The program compiles, via state cancer registries, cancer morbidity and mortality rates on a state-by-state basis, and then reports out these statistics as part of an effort to reduce the cancer burden among the U.S. population. One challenge in assessing these statistics involves the migration of patients who move out of and between states. Federal law (HIPAA, HiTECH, etc.) does not allow for the easy sharing of Private Health Information (PHI) and hence, the state registries cannot simply share information to identify patients who might otherwise be counted more than once. The end result of this limitation is an over-reporting of the actual U.S. cancer burden.

The Institute for Computational Biology (ICB) has partnered with Health Data Link, a start-up company out of Northwestern University, in an effort to assist the SEER program and the state registries with being able to identify which cancer patients have been seen in more than one state, as well as which patients have been counted more than once intra-state. Software called HealthLNK (developed at Northwestern) uses a well known RSA-512 encryption algorithm, which has been approved to secure private patient data, to create hashed bundles of de-identified data which are then shared with the ICB. Another algorithm is then employed to detect matches of the aggregated hashed data. Match results are sent back to the respective participating states, who then determine how many incidences of reported in-state cancer cases are duplicates and also a match to out-of-state registries.

We illustrate here the results of a pilot study we performed with the Idaho and Colorado cancer registries, as well as future plans for expanding this technology to 4 additional states, with the ultimate goal of expanding to 47 states.
Electrical stimulation through nerve cuff electrodes (NCEs) implanted in the lower extremities of individuals with spinal cord injury (SCI) have allowed recipients to achieve standing. Current systems use constant, simultaneous stimulation of the knee extensors through NCEs on the femoral nerves. However, constant stimulation induces rapid fatigue of targeted muscles, limiting standing duration. To delay fatigue and increase standing times, advanced stimulation paradigms are being investigated. These paradigms alternate stimulation delivered through each contact to reduce the muscles’ duty cycles and allow some fibers to recover while others contract. Carousel stimulation cycles between independent pools of motor units while sum of phase-shifted sinusoids (SOPS) stimulation produces out-of-phase sinusoidal moment of synergists for a larger net joint moment than individual pools. Both paradigms can generate adequate, stable moments about the knee for standing.

Constant, carousel, and SOPS paradigms were evaluated in one man with SCI (C6 AIS C) who received bilateral femoral 8-contact composite flat interface nerve electrodes (C-FINES). Three contacts in each C-FINE, selective for distinct populations of knee extensors, were used to implement the paradigms. Knee moments were recorded using a JR3 load cell and stimulation adjusted to produce equal moment when stimulating through each contact. Time to fatigue, when moment dropped below that required for quiet standing, 0.135 Nm/kg, was calculated. This was shorter with constant stimulation (5.8 and 5.0 minutes for the right and left legs, respectively) than with carousel (6.3 and 8.5 minutes) or SOPS (18.7 and 25.8 minutes). However, functional tests while standing on force plates with the same subject did not show a significant increase in standing times or reduced metabolic effort with the new paradigms. This is expected to improve by optimizing stimulation in real-time, for instance with a moment-matching controller.
Core facilities are shared resources at CWRU, providing access to advanced instrumentation and technologies operated by experts. Core facilities and service centers are important research resources, connecting scientists and engineers with the tools and expertise that can propel their research projects to higher levels.

**Abstract**

Case Western Reserve University's Core Facilities and Service Centers offer access to a wide variety of services and instruments, from cell sorting and solar cell testing to polymer compounding and high-resolution electron microscopy. Faculty and staff with decades of technical and scientific experience support these facilities. The Service Centers Group will present information from a swath of facilities across campus, and make their physical and intellectual resources accessible in a user-friendly way. Our booth will consolidate information from participants in the group, including descriptions of individual capabilities, and technical staff to discuss research capabilities and needs. Lastly, the Service Centers Group will have posters highlighting center capabilities and interesting projects, in addition to samples of interest. Participating service centers range across schools, including the Case School of Medicine, Case School of Engineering, and Arts & Sciences. Check us out to learn about the cutting edge center capabilities available to both internal CWRU users, and externally, to other academic and industrial users.
Abstract

Background: The Behavior Change Technique Taxonomy (BCTTv1) was developed as a common language for describing behavior change interventions across disciplines (Michie, 2013). This taxonomy tool can be used to identify the behavior change techniques that are the most effective and most frequently used in multi-component interventions. Requisite to using a taxonomy to identify and classify behavior change techniques, however, is the need to establish inter-rater reliability among taxonomy coders.

Purpose: The purpose of this study was to determine the feasibility and reliability of novice coders in coding the behavior change techniques (BCTs) used in two theoretically-different interventions of a randomized clinical trial to reduce childhood obesity.

Methods: The process involved a pair of expert coders and a pair of novice coders. Novice coders received 120 hours of online training over 3 months, including phone and e-mail correspondence with expert coders. Each person of the two pairs (expert and novice coders) independently coded the materials from two interventions. The materials consisted of 884 pages of the interventionist protocol manual and participant materials used in a 1-year family-oriented behavior change intervention that met face-to-face every 2 weeks. The materials for both interventions were coded separately by each coder with adjudication by coder pairs in early phases of coding. The number of BCTs identified by each set of coders were recorded, and inter-rater reliability was calculated using prevalence- and bias-adjusted kappa (PABAK) and percent agreement.

Results: Training for each novice coder took approximately 125 hours. It took 120 hours for each novice coder to independently code the intervention materials. Inter-rater reliability between the novice coder pairs were PABAK scores of 0.80 and 0.81 and agreement scores of 88% and 90% for the two interventions, respectively. Reliability between novice coder pairs and expert coder pairs showed PABAK scores of 0.46 and 0.59 for the two interventions (acceptable PABAK ? 0.67 (Sim and Wright, 2005)). Percent agreement was 73% and 80%, respectively.

Conclusions: The results indicate good taxonomy coding inter-rater reliability among novice coders of two different interventions. Although the PABAK scores were not as high between novice and expert coders, the agreement was still good. Our results indicate that with adequate training, reliable taxonomy coding of behavior change techniques in behavior change interventions can be successfully achieved with newly trained individuals.
Most organic electron acceptors used for organic photovoltaic (OPV) applications are fullerene based. However, fullerenes are expensive and do not absorb much light. Zinc azadipyrromethene (ADP) chelates are good candidates as electron acceptors for OPVs due to their intense light absorption in the visible to near IR regions and high electron affinity. Previously, we synthesized an ADP-based electron acceptor containing phenylacetylene arms, Zn(WS3)2, which performed well in OPVs when blended with poly(3-hexylthiophene) (P3HT). In this work, we added fluorine in various positions to Zn(WS3)2 to further enhance the electron affinity and study the effect of positioning of the electron withdrawing groups. The fluorinated acceptors were tested in organic solar cells using P3HT as the electron acceptor. Depending on the position of the fluorines, the addition of fluorine either increased (for three acceptors) or decreased (for one acceptor) power conversion efficiencies (PCE) compared to the unfluorinated Zn(WS3)2 acceptor. To understand these results, we are currently analyzing morphology and charge carrier mobility in blends. The increased efficiency for three out of the four fluorinated acceptors demonstrate that fluorination is a promising method to develop better acceptors for OPVs.
Abstract

Background: The impacts of ESRD on all aspects of life can be tremendous. Children with ESRD struggle with major difficulties in their growth and development, peer relationships, and school performance. Such impacts of ESRD can affect the quality of life negatively, an outcome measure that has been commonly associated with adherence, mortality, and general health outcomes.

Objectives: The aim of this paper is to provide an overview of the current state of knowledge on HRQOL research in children with ESRD.

Methods: PubMed, CINAHL, and Ovid databases were searched using the search terms included "HRQOL" and "QOL" combined with "Pediatric ESRD" or "children with chronic kidney disease (CKD)." The majority of the studies were cross-sectional, conducted in the U.K., U.S.A, Poland, Spain, Korea, Netherlands, Brazil & Egypt.

Results: Children with ESRD have poor HRQOL as compared to the healthy population. HRQL varies according to treatment modality, disease severity, and the presence of comorbidity. Children with hemodialysis reported lower HRQOL compared to children with peritoneal dialysis. There are many methodological issues such as the lack of randomized control trials, the lack of standardized Pediatric QOL measures, and the lack of theoretical frameworks, and the lack of interventional studies. Thus, evidence is limited and inconclusive.

Conclusion: Early assessment and regular monitoring of HRQOL are highly indicated to minimize the impacts of ESRD on growth and development, and to enhance physical, emotional, social, and school functioning among children with ESRD. Multinational, longitudinal, as well as interventional studies, are warranted to identify and examine the association between medical and demographical variables that influence HRQOL.
The Use of Objective Structured Clinical Examination (OSCE) and Standardized Patients (SPs) in Advanced Nursing Education: A Literature Review

Background: The objective structured clinical examinations (OSCEs) and standardized patients (SP) are effective clinical evaluation methods. In nursing education OSCEs/SPs have been used in a limited range and with few reports at the graduate level.

Objective: This paper is a review of the literature on the use of OSCEs and SPs in advanced practice nursing education.

Method: Nine studies from advanced practice education and eight studies in undergraduate education were reviewed for common advantages and disadvantaged of OSCEs and SPs.

Results: OSCEs/SPs are objective, valid, and reliable. OSCEs/SPs offer opportunities for students to practice wide range of clinical skills. OSCEs/SPs are costly and induce anxiety among students. However, students valued the OSCE experience and educators confirmed that its benefits outweigh its cost.

Conclusion: OSCEs/SPs are effective evaluation methods. Evidence that supports the validity and reliability of OSCEs/SPs is limited. OSCEs/SPs are better used in addition to the traditional clinical evaluation methods and they may not totally replace them.
Loss of Cyclin Dependent Kinase 5 in activated CD4+ T cells Results in Peripheral T Cell Tolerance

Cyclin dependent kinase 5 (Cdk5) is an atypical, cell cycle-independent serine/threonine kinase originally studied in neurons as a key mediator of cell migration and synapse formation, among other functions. Our lab is the first to report on the importance of Cdk5 activity during T cell activation, having established that T cell-specific loss of Cdk5 ameliorates disease in preclinical murine models of multiple sclerosis and graft-versus-host disease. Nonetheless, the mechanism through which Cdk5 mediates T cell-driven pathogenesis is not fully understood. Here we report that loss of Cdk5 activity in activated CD4+ T cells compromises downstream T cell receptor (TCR) signaling, resulting in failed T cell activation and inducing peripheral T cell tolerance. After TCR ligation, naïve T cells subjected to lineage-specific genetic deletion or pharmacologic suppression of Cdk5 exhibited diminished IL-2 production and reduced proliferation. Our phosphoproteomic and coimmunoprecipitation studies revealed that Cdk5-mediated Coronin 1a phosphorylation is required for Coronin 1a complex formation with PLCγ1. Additionally, Cdk5-deficient T cells exhibit low PLCγ1 activity as measured by IP3 production, which results in low Ca2+ mobilization. Since PLCγ1 byproduct DAG acts through PKCγ to activate Ras signaling, we tested the effect of Cdk5 inhibition on Ras-dependent upregulation of T cell activation marker CD69. Although our Western blot analysis confirmed intact upstream TCR signaling in Cdk5-deficient cells, TCR stimulation failed to upregulate surface expression of CD69 or activation marker CD44. These results suggest that loss of Cdk5 activity leads to decreased Ras-MAPK pathway signaling that is insufficient for T cell activation, prompting peripheral T cell tolerance, either through anergy or apoptosis. Therefore, Cdk5 may be a potential pharmacological target for induction of T cell tolerance, a promising therapy for patients with T cell-mediated autoimmune disease.
In 1915, Einstein proposed the revolutionary Theory of General Relativity (GR). The theory states that matter warps the fabric of space-time and the resulting curvature alters the path of matter. In the past hundred years, GR has passed all the rigorous tests it has been put to, most recently the confirmation of the existence of gravitational waves by LIGO in 2016. One of the predictions of GR is that the rate of the expansion of the Universe should slow down due to the presence of matter in the universe. However, independent observations (made by Reiss, Schmidt & Perlmutter) in the sky showed that the expansion is instead speeding up. Astonishingly, if this accelerated expansion is driven by some new form of energy, then this mysterious "dark energy" occupies 72% of total energy density, the rest being mostly dark matter and only 5% ordinary matter. There is no widely accepted origin for this dark energy.

In 2011, de-Rham-Gabadadze-Tolley (dRGT) showed that General Relativity could be altered by giving the graviton (a particle that arises from GR) a small mass. It was hoped that this small but crucial modification of GR would explain the accelerating expansion. Unfortunately, the theory known as dRGT Massive Gravity, runs into difficulties accommodating the detailed properties of our universe. More recently, a modification to dRGT, known as Extended Quasi-Dilaton Massive Gravity (EQDMG), has been proposed, that can give rise to accelerated expansion. Our current work shows that the values of the cosmological parameters of EQDMG that have previously been identified as promising, cannot describe our universe. At the same time, we have identified new regions of parameter space whose viability we are exploring.

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Neurocognitive (NC) decline is a growing concern among HIV-infected (HIV+) adults as they age and may involve dysregulated cerebrospinal fluid (CSF) iron transport. This longitudinal study examined relationships between CSF iron biomarkers, APOE-ε4 genotype, and NC decline in HIV+ adults in a large observational cohort study who underwent comprehensive NC testing (the Global Deficit Score, GDS) at baseline and 6-month intervals up to 42 months (mos.). CSF iron, heavy-chain ferritin (H-ferritin) and transferrin were quantified in 403 participants. NC change status (improved/stable/declined) was defined at specific visits or last follow-up compared to baseline. Biomarker associations with NC function were evaluated by linear and repeated-measures analysis of variance regression analyses, adjusting for age, comorbidity, zidovudine (ZDV) use and APOE-ε4 carrier status. Of 403 HIV+ adults (22% aged<50, 73% on ART, 68% with undetectable virus, 19% women), 157 completed follow-up at 30 mos., 131 at 36 mos., and 110 at 42 mos. Transferrin and H-ferritin were higher in men and persons aged<50 years but were unrelated to APOE-ε4 status. Higher H-ferritin at baseline was associated with NC improvement at last follow-up in HIV+ adults aged<50, adjusting for age, comorbidity, ZDV use, and APOE-ε4 status, with relative risk 1.17 vs. stable status [p=0.01, 95%CI=1.03-1.33]. H-ferritin and transferrin were also associated with GDS differences at 30, 36 and 42 mos., adjusting for comorbidity [p<0.05 for both H-ferritin and transferrin; 0.5-1.1% of total GDS variance explained]. Baseline H-ferritin was also associated with better GDS in persons aged<50 at 30, 36, and 42 mos. (1.3% GDS variance explained). In APOE-ε4 carriers aged<50, transferrin was associated with GDS at 30 mos. (11.6% GDS variance explained). CSF iron biomarkers are independently associated with GDS differences over time in HIV+ adults, but further studies in larger samples are needed to confirm these findings.
Urban health problems are complex. Public health researchers and practitioners discuss the impact of environment, policy, and social determinants on health. The PRCHN at CWRU has forged partnerships with community stakeholders to develop a comprehensive, integrated research agenda through the creation of its Network of Community Advisors (NOCA). Based on the CBPR framework, NOCA is the primary advisory to PRCHN. Working along faculty/staff, NOCA brings neighborhood issues to the Center's attention, identifies priority research areas, and helps determine effective ways to share findings. NOCA has 25 members from grassroots organizations, local government, schools, community residents, healthcare, foundations, and faith-based institutions. NOCA meets quarterly. Its three committees – Research, Community TIES, and Governance meet an additional 6 times each year to understand and guide PRCHN's work. NOCA members are invited to participate on research projects' committees. These committees inform, monitor, review and disseminate PRCHN research that advances understanding of health and social issues contributing to the larger body of public health research and to impact communities. The NOCA-PRCHN collaboration assists in developing, testing, and disseminating effective strategies addressing chronic disease. This helps NOCA members develop deeper understanding of research principles; informs the evaluation of effectiveness of their programs and projects; allows for PRCHN provided technical assistance. This partnership has developed dissemination strategies to ensure that Center research findings are shared with community and practitioners. 1) Research Dissemination Day - Food Access and Food Security Among Cleveland Residents - drew 150+ participants to learn from faculty and NOCA member’s findings in community health and food systems research; 2) helped secure additional grants; 3) and assisted with policy enactment on raising minimum age for tobacco sales to 21.
Role of the Amyloidogenic Low Complexity Domain of TDP-43 in Protein Aggregation Observed in Neurodegeneration.

Understanding the aggregation mechanisms of TDP-43 in the brain is crucial to developing therapeutic approaches for treating neurodegenerative diseases. We have developed an aggregation model for wild type TDP-43 and have shown prion-like characteristics that might allow for propagation throughout the body, which may be further regulated by disease-causing mutants.

Key Words
- Neurodegeneration
- TDP-43
- amyotrophic lateral sclerosis
- frontotemporal lobar degeneration
- prion

Abstract
Over the past decade, intrinsically disordered protein (IDP) aggregation and associated prion-like character have become recognized as hallmarks of neurodegeneration. Aggregation of the transactive response DNA-binding protein (TDP-43) appears to be a heterogeneous phenomenon in amyotrophic lateral sclerosis (ALS) and frontotemporal lobar degeneration with ubiquitination (FTLD-U), as full-length and truncated species are found with varying morphologies across patients and are differentially observed even within the same patient. Though some reports argue that TDP-43 aggregation is mediated through the formation of cytoplasmic stress granules—highly dense RNA and protein-rich phase separations—, in vitro work within and outside of our lab suggests that TDP-43 maintains an intrinsic amyloidogenic capability even at low concentrations. Yet the contributors to formation of specific aggregate species and the role of familial-associated mutations remain poorly characterized and whether these mutations impact its prion-like character is unknown. In this work, we present a well-controlled and structurally-defined model of TDP-43 aggregation through manipulation of its low complexity domain (LCD). Utilizing varying pH and ionic strength, we have shown that the LCD aggregates in a prion-like fashion but appears to form structurally distinct aggregates (oligomers and fibrils) depending on the surrounding environment. Furthermore, the relative impact of disease-associated mutations on aggregation rates, prion-like capabilities, morphologies, and folding patterns are depicted and continue to be of primary interest in our future studies.
Engineered cartilage has the potential of providing a biological treatment for osteoarthritis. However, efforts so far have yielded tissue that is not capable of functioning under multiple high-load cycles that joints are subjected to. Developing functional tissue is an interdisciplinary task spanning tissue biology and engineering. This range of disciplines focused on engineered cartilage is not available in most tissue engineering (TE) laboratories. The recently established Case Western Reserve University Center for Multimodal Evaluation of Engineered Cartilage is a resource that provides such a broad range of assessment techniques to the national and international TE community. This abstract illustrates an interdisciplinary approach to developing and assessing TE cartilage that the Center can provide.

We have developed a damage assay that subjects cartilage to combined compression and sliding shear and have shown that scaffold-free engineered cartilage fails catastrophically under these conditions. Failure is related to low collagen content. Thus, an avenue to increasing collagen concentration was pursed, and the resulting tissue was then evaluated using the damage assay. It was hypothesized that Thyroxine (T4) would increase collagen synthesis and reduce tissue damage. Scaffold-free cartilage was generated with and without T4 for 2 months using chondrocytes seeded onto porous polyester membranes.

Results showed that total collagen was increased 2.1±0.8 fold (p<0.01, n=7) at 1 month and 2.1±0.4 fold (p<0.001, n=5) at 2 months. When subjected to the damage assay, damage was 0.3±0.3 fold that of controls (p<0.05, n=5) at 2 months. Thus, T4 increases collagen concentration and improves function of engineered cartilage. This cycle of a TE intervention and evaluating the resulting tissue is an example of how the Center can benefit the tissue engineering community.
**Title**: Prazosin in Children and Adolescents with Posttraumatic Stress Disorder Who Have Nightmares - A Systematic Review

**Elevator Speech**: Prazosin has shown promising outcomes in treating nightmares associated with PTSD in children and adolescents, although this has not been well studied. Future placebo-controlled trials are needed to assess the efficacy and safety of prazosin in treating PTSD related nightmares in children and adolescents.

**Key Words**: Prazosin, PTSD, Nightmares, Child and adolescent

**Abstract**

Objectives: The aim of this systematic review is to identify published articles that evaluated the use of prazosin for treating nightmares in children and adolescents who have Posttraumatic stress disorder (PTSD).

Method: A literature search was conducted of PubMed, Medline, Embase, Cochrane collaboration and Psych Info databases for published articles in any language that evaluated the use of prazosin for treating nightmares in the context of PTSD in children and adolescents using key words; PTSD, nightmares, prazosin, children, adolescents, trauma and sleep.

Results: A total of nine published articles related to the use of prazosin for treatment of nightmares in PTSD in children and adolescents were identified. Six of the nine articles that met our inclusion criteria were case reports. All of these six case reports showed marked improvement in nightmares when prazosin was used, though at a generally lower dose when compared to its use in adults, with dosing ranging from 1-4 mg /day.

Conclusion: Prazosin has shown promising outcomes in treating nightmares associated with PTSD in children and adolescents, although this has not been well studied. Future placebo-controlled trials are needed to assess the efficacy and safety of prazosin in treating PTSD related nightmares in children and adolescents.
Abstract

Secure data management ensures our ability to acquire, manage and analyze biomedical research data efficiently, safely, and compliantly. University Technology (UTech) developed, manages, and maintains a Secure Research Environment (SRE) for computing, governed by a security program that includes the implementation of controls meeting recommendations and requirements of regulatory and information security standards including HIPAA, FISMA, and SANS/ISO. The platform utilizes standardized operating procedures, rigid access control, auditing and encryption procedures to minimize risk. Within the SRE, the Institute for Computational Biology (ICB) has deployed the Safely Held Electronic Data platform (SHED) for investigators. The SHED provides standardized data management tools allowing for customized data structures, longitudinal tracking of study subjects (including disease profiles and outcomes) and storage of versioned IRB protocols, subject consents, clinical findings (including images) and pedigree-formatted family data. The capability for complete biospecimen tracking (annotations, locations, chains of custody, barcodes), cell and cell lines annotation, and reporting (research-oriented+administrative) is also provided.

Software applications in the SHED include On-Core® Enterprise and LabMatrix™. OnCore® is a web-based, comprehensive and widely used Clinical Trials Management System providing security, audit trails, and process visibility. LabMatrix™ is a highly configurable web-based platform for collecting, organizing, maintaining and sharing clinical research biospecimen data. SHED currently manages 100,000+ biospecimens and 30,000+ subjects in almost 400 different studies and clinical trials. The SRE also houses the natural language processing tools, TIES and cTAKES. Finally, CLEARPATH (CLEveland Area Research Platform for Advancing Translational Healthcare) will added to the SRE this fall. Here we illustrate the SRE/SHED research environment and offerings.
Pentameric ligand gated ion channels (pLGICs) belong to the cys-loop super family and are responsible for fast chemical transmission of nerve signals in the central and peripheral nervous system. These channels are modulated by a number of therapeutics such as alcohol, anesthetics, neurosteroids. Membrane lipids have also been shown to modulate this family of receptors. pLGICs have three distinct states namely closed, open and desensitized states. Desensitization in pLGICs plays a crucial role in regulating neuronal excitability. Although a large number of high resolution structures have been solved in the past decades, a molecular understanding of how the desensitized state impedes ion flow is still unknown. Here, we choose prokaryotic homologue, GLIC, a proton gated bacterial ion channel from Gloeobacter violaceus. We show that docosahexaenoic acid (DHA), a key ω3-polyunsaturated fatty acid in synaptic membranes, stabilizes the desensitized state in GLIC. We determined a 3.25 Å structure of DHA bound desensitized GLIC. In this previously unobserved conformation, the extracellular-half of the pore-lining M2 is splayed open, reminiscent of the open conformation, while the intracellular-half is constricted, leading to a loss of both water and permeant ions. These findings, in combination with EPR spectroscopic measurements in reconstituted membranes, provide novel mechanistic details of desensitization in pentameric channels.
Abstract

Nonsense-mediated mRNA decay (NMD) is a cellular quality control pathway for gene expression that identifies and targets aberrant mRNAs for accelerated degradation. Detection and rapid elimination of mRNA containing nonsense mutations helps to maintain fidelity in gene expression by preventing the accumulation of truncated polypeptides that are likely to have deleterious effects on the cell. Three proteins make up the core NMD machinery - namely Up-framesshift 1 (Upf1), Upf2, and Upf3 – and although all three proteins are required for NMD, Upf1 is the only factor with known enzymatic activity and an ability to bind directly to RNA. Currently, key mechanistic events underlying how the NMD machinery recognizes its substrates remain unclear. It has been previously observed that Upf1 preferentially associates with nonsense-containing mRNA and binds substrates even in the absence of Upf2 or Upf3. We are using the budding yeast model, Saccharomyces cerevisiae, to extend these preliminary findings and determine key mRNA features that influence Upf1 association with substrates, and whether various activities intrinsic to Upf1 are required for its association with mRNA.

We have developed a biochemical approach to monitor Upf1 binding with mRNA involving immunoprecipitation and measurement of the associated RNA by qRT-PCR. Data from this study will be presented in support of the following observations: (i) Upf1 demonstrates a strong preference to bind nonsense-containing mRNA and that its ability to bind and hydrolyze ATP is dispensable for its association with RNA, (ii) Upf1 displays an RNA length-dependent association with RNA substrates that is, importantly, dependent upon translation of the mRNA, and (iii) RNA secondary structure downstream of the nonsense-codon stabilizes NMD substrates and abrogates the association of Upf1 with the mRNA. Taken together, our data provide insight into the role of Upf1 and overall mechanism of NMD substrate recognition in S. cerevisiae.
Impact of Intra-Operative Hemoglobin and Lactate on the Post-Operative Renal Function in Patients Undergoing Elective Cardiac Surgery.

Background and aim
Results after elective coronary artery bypass surgery (CABG) are excellent in the current era. However, we do not understand the impact of critical intra-operative variables on early post-operative outcomes. The goal of this study was to examine the impact of serum lactate and hemoglobin levels on renal function and post-operative outcome in low-risk elective coronary artery bypass surgery patients.

Methods
We selected patients undergoing elective coronary artery bypass surgery on cardiopulmonary bypass (CPB) between December 2013 – July 2016 in our hospital. Patients with abnormal renal function (baseline creatinine > 2 mg/dL) were excluded; Estimated GFR (eGFR) was calculated using the CKD-EPI equation; the post-operative eGFR was calculated after monitoring serum creatinine levels for 72 hours post-operatively and using the highest creatinine value within that timeframe. Acute kidney injury (AKI) was defined utilizing the percent change in GFR and the RIFLE scoring system.

Results
Over the 3 year period, 375 patients fulfilling study underwent elective CABG. From them, 56/375 developed AKI. Multi-variable regression demonstrates that high peak Lactate levels (OR 1.44, CI 1.15 – 1.82), low nadir Hemoglobin (OR 0.69, CI , 0.49 – 0.96), and male gender (OR 2.58, CI 1.21 – 5.85) were associated with development of AKI.

Conclusions
High peak lactate and low Hemoglobin during cardiopulmonary bypass are associated with increased odds of developing acute renal failure after elective open heart surgery.
In order to more accurately determine the changing rate of real world photovoltaic (PV) systems, a month-by-month analysis method has been developed to extract features and change rates from the measured power output of PV systems in the field. This method consists of three models. The first model (?? model) subsets the data into 30 day long pseudo month segments and creates a linear regression model of the power output based on the weather conditions for each pseudo month. Standard weather conditions for the entire data range are calculated and applied to each pseudo month ?? model to determine a normalized predicted power output. The second model (?? model), plots a piecewise weighted linear regression fit to the predicted power output determined by the ?? model. The ?? model is weighted to the inverse of the error of each ?? model. The changing rate of the system is determined from the slope of the ?? model. The final model (?? model), is used to rank the importance of the predictors of the PV system, such as Koppen-Geiger climate zone or the brand of the module being used. Applying the month-by-month analysis to over 650 PV plants within our data scope has shown the Koppen-Geiger climate zone is the most important variable affecting the change rate, followed by the module brand, and the age of the system. Analysis of the piecewise fits has shown a trend for PV plants to show increasing performance at the beginning of operation, followed by decreasing performance as time goes on.
This investigation highlights the potential for electrospun nanofiber mats and self-assembled nanofiber networks to be interfaced synergistically to elicit hygromorphic behavior. Hygromorphism is utilized by seed pods in nature to generate dynamic curvature in response to hydration through humidity or rainfall. The properties guiding hygromorphism, such as water transport, layer thickness, and layer modulus, were tailored by varying the compositions of electrospun fiber active layers and molecular gel passive layers encapsulated in an elastomeric matrix. Experimentally-determined material constants were utilized in conjunction with mathematical modeling to determine ideal layer properties. The hygromorphic bilayer composites fabricated using these ideal control layers exhibited folding bias and response variations dependent upon active layer composition and imposed folding directions. By utilizing the favorable force balances between the active layer with the lower fiber content and the passive layer with the highest gelator amount in conjunction with folding bias in a non-preferential direction, it was possible to achieve hygromorphic unfolding and refolding with hydration. The versatility of this bilayer platform was displayed by exploring material changes the electrospun nanofiber active layer. In particular, aligned electrospun nanofibers were used to control transport direction and program the response shape. Through modelling and individual layer examination, a unique platform built on two independent fiber networks has been designed to achieve biomimetic hygromorphism in synthetic bilayer composites.
HIV-Associated Neurocognitive Disorder (HAND) is a term that captures a wide spectrum of neurocognitive deficits, ranging from mild to severe, in HIV-infected persons. The genetic underpinnings of this complex phenotype are incompletely understood. Abnormalities of mitochondrial function and iron metabolism have long been implicated in neurodegeneration. In this analysis, we aimed to characterize the mitochondrial DNA (mtDNA) haplogroup interactions with nuclear genes found to be associated with HAND phenotypes.

Methods
Genetic associations with HAND were investigated in the CHARTER cohort, encompassing 1025 individuals of African, admixed Hispanic and European ancestry. CHARTER is a U.S.-based observational study of neuro-HIV outcomes in ambulatory, HIV+ adults who underwent standardized, comprehensive NC assessment (2003-7) and were assigned a Global Deficit Score (GDS) [normal (GDS<0.5) or impaired (GDS?0.5)]. We employed a polygenic modeling approach to investigate the global effect of previously associated nuclear SNPs.

We found evidence of interactions between nuclear genomic SNPs en masse and mtDNA haplogroups within European and African-ancestry individuals. The analysis of each SNP by mtDNA haplogroup combination identified significant interactions between a region of chromosome 19 (two strongly correlated SNPs, rs17160128 and rs12460243) and European mtDNA haplogroups in HAND, with the SNPs showing a more dominant association in H and J haplogroups versus a more additive association in T and UK haplogroups.

These findings were demonstrated using a novel analytic approach and indicate a new potential genetic mechanism in the pathogenesis of HAND, which may lead to greater understanding of the pathophysiology of this neurocognitive disorder.
The Materials for Opto/Electronic Research and Education (MORE) Center advances science and innovation with facilities and expertise enabling the fabrication and characterization of materials and devices for emerging electronic and optoelectronic technologies, including solar cells and lighting. Located in the Charles M. White Metallurgy building, the MORE Center is a hub for undergraduate and graduate research, education, and collaboration. The center has 27 tools available for both direct use and service work; in addition to a suite of thin film deposition options, the MORE Center has profilometry, ellipsometry, and microscopy characterization tools, a cleanroom facility, electron and photolithography capabilities, and inert gloveboxes for work with air sensitive materials. The two newest additions to the MORE Center, a large area non-contact profilometer, and a mechanical tester will be highlighted.

In six years of operation, the MORE Center has amassed over 300 users from thirty research groups across Arts and Sciences, the Case School of Engineering, and the Case School of Medicine. The MORE Center is open to internal, external academic and industrial users. For rates, training, and project discussions, contact Ina Martin at ixm98@case.edu.
Abstract

HIV-Associated Neurocognitive Disorder (HAND) is a term established to capture a spectrum of neurocognitive (NC) deficits associated with HIV infection. The genetic underpinnings of HAND are poorly understood. CHARTER is a U.S.-based observational study of neuro-HIV outcomes in ambulatory, HIV+ adults who underwent standardized, comprehensive NC assessment (2003-7) and were assigned a Global Deficit Score (GDS) (normal (GDS<0.5) or impaired (GDS≥0.5)). In this study, we investigated the impact of genetic variants known to alter the expression of genes in whole blood on GDS outcomes.

We used CHARTER genome-wide association study (GWAS) data (imputed to the 1000 Genomes reference) to predict gene expression using an approach called PrediXcan. It estimates the genetically regulated component of gene expression using reference panels from studies of expression quantitative trait loci (eQTL). We performed regression analyses to identify predicted gene expression values that associate to continuous GDS and GDS impairment, adjusting for population effects and known clinical covariates (comorbidity status, current CART use, plasma viral load, nadir CD4+ T-cell count).

Initial analysis suggests overrepresentation of iron ion binding, immune defense response, regulation of inflammatory process and mitochondrial-mediated membrane pathways.

Using PrediXcan, we have identified genes and pathways potentially influencing NC impairment in HIV-infected individuals. Based on these findings, we further hypothesize that individuals with altered regulation of HIV-interacting genes may be predisposed to HAND in the presence of HIV infection.
Cancer stem cells (CSC) are considered the seeds that mediate metastatic dissemination and contribute to the high incidence of recurrence in triple-negative breast cancer. The transcription factor BCL11A is necessary for CSC properties and represses an alternative splicing program that may contribute to the highly metastatic nature of this disease.

Abstract

CSC are considered the seeds that mediate metastatic dissemination and contribute to the high incidence of recurrence in triple-negative breast cancer (TNBC). Elucidating the mechanisms controlling CSC properties will provide novel targets for therapeutic development to improve patient outcomes. The transcription factor BCL11A is the most differentially expressed gene in TNBC versus all other subtypes and controls breast cancer stem cell (CSC) phenotypes. However, the genes that BCL11A targets to control CSC biology and whether BCL11A promotes metastatic progression are unknown. BCL11A is highly expressed in the CSC-enriched compartment of TNBC cells, correlating with increased NANOG-promoter activity. Transient silencing of BCL11A in TNBC cells decreases expression of the CSC marker, CD44, and reduces the CD44HI/CD24LO CSC population. While BCL11A silencing does not impact TNBC cell viability or migration, it reduces in vitro invasion, suggesting that BCL11A may be critical for metastatic progression. To identify the BCL11A-regulated transcriptome in TNBC, we performed RNA-seq analysis control or BCL11A-silenced cells yielding 154 differentially expressed genes whose expression was altered with changes in BCL11A. Gene set enrichment analysis revealed enrichment of differentiated luminal-like breast cancer and mammary stem cell genes, including a ~2-fold upregulation of the splicing regulator, Muscle-blind Like 1 (MBNL1). Further analysis of the RNA-seq dataset revealed that several MBNL1 target genes are alternatively spliced, suggesting that the increased expression of MBNL1 is accompanied by increased activity. Furthermore, preventing the rise in MBNL1 that occurs with BCL11A silencing reverses the invasion phenotype, indicating that MBNL1 is a key target of BCL11A that controls TNBC cellular invasion. Together, these data suggest that BCL11A sustains TNBC cell invasion through repression of an MBNL1-directed splicing program.
The basal and claudin-low subtypes of breast cancer are the most aggressive subtypes and they convey the poorest prognoses due to a lack of targeted therapies. Both subtypes are referred to as “triple negative” breast cancer (TNBC) as they lack expression of estrogen, progesterone, and HER2 receptors. Modulation of the epigenetic drivers that dictate the breast cancer transcriptomes could provide a mechanism to modulate the aggressiveness of TNBC. One such driver may be BRD4, a member of the Bromodomain and Extra-Terminal domain (BET) family of proteins that epigenetically regulates transcription. BRD4 is enriched at the promoter of oncogenes, resulting in oncogene transcription. JQ1 is a small molecule inhibitor of BRD4 that disrupts BRD4 interactions with acetylated histones. We have found that long-term exposure to BET inhibitors (BETi) induces 2 predominant responses: senescence or cell death. Growth suppression in TNBC is further accompanied by reduced expression of numerous mitosis/cytokinesis genes including FOXM1, Aurora kinase A, Aurora kinase B, and Cyclin B1. BCL-xL, an anti-apoptotic protein, is important for susceptibility to Aurora kinase inhibition. We discovered that the levels of BCL-xL are higher in cells that undergo polyplody and senescence compared to those that become polyploid and then apoptose in response to BETi. Thus, we hypothesized that BCL-xL may control cellular response to BETi. We found that inhibition of BCL-xL by BCL-xL siRNA as well as by the BCL2 family member inhibitor, Obatoclax, shifted the response to BETi from senescence to cell death. In addition, BCL-xL overexpression abated the response to BETi in cells that normally undergo apoptosis as a response to BETi. These data suggest that a combination BET and BCL-xL inhibition treatment may be useful for overcoming TNBC in a group of breast cancer patients who otherwise have a poor prognosis.
Background
The purpose of this research is to describe successful recruitment strategies for a community-based evaluation project, The Future of Food in Your Neighborhood Study (foodNEST). The foodNEST project looks at how changes in the food retail environment have an impact on the health of a community by examining the diet and health, food shopping habits, and food access among residents living in two urban communities in Ohio through three surveys conducted per year for three years.

Methods
Recruitment occurred in two sociodemographically matched, food desert communities within two Ohio cities. A number of strategies were employed by the recruitment team, some of which included meeting with key community stakeholders to connect with leaders at various businesses and organizations. Marketing materials (e.g., handing out flyers, sending postcards, and advertising in local mailers and newsletters, recruiting events at local grocery stores, institutions, and community centers) were distributed within each community.

Results
Recruitment began in August 2015 and concluded in September 2016. A total of 1,396 were reached using the aforementioned strategies. The majority (41.4%) learned of the study via word of mouth and 26.2% learned through advertisements. A total of 719 individuals were eligible to complete the surveys. From the 677 participants that were not eligible, the majority lived outside of the study area. Of the eligible participants, 565 (retention rate = 78.6%) completed survey 1, 539 (95.4%) completed survey 2, and 529 (98.1%) completed survey 3. The final cohort was 516.

Conclusion
Strategic and community-tailored recruitment strategies are necessary for successful recruitment and retention of individuals for a longitudinal study.
Computerized Rotational Jet Spraying of Polymers for Biofabrication of Composite Tubular Scaffolds

Medical professionals need, mechanically robust medical devices that are habitable for cells. However, there isn't a single material with both characteristics. We have developed a method to create layered hybrid structures using biological and synthetic materials to achieve the desired properties, which cannot be achieved using existing methods.

Tubular medical devices are used in numerous medical applications in urological, cardiovascular, orthopaedic, throat surgery as stents, catheters or tissue repair scaffolds. In applications where cell attachment and tissue integration is critical, most synthetic polymers may have limitations. For example, polycaprolactone is a well-researched biomaterial with a long degradation time and robust mechanical properties that make it suitable for implanted structures such as scaffolds and stents. Collagen has excellent cell affinity, but lacks desirable mechanical properties. The purpose of this study was to develop computerized rotational jet spraying as a biofabrication method that will enable manufacturing of tubular polycaprolactone scaffolds which are hybridized with collagen for enhancement of cell adhesion.
BACKGROUND: Chronic fatigue syndrome (CFS) is a condition that affects more than 1 million people in the United States. It is characterized by persistent fatigue that does not parallel the amount of effort exerted and lasts for at least 6 months.

METHODS: This project analyzed and summarized the validity of research on the causes of CFS and examine the effectiveness of its current treatment.

RESULTS: CFS induces physical and mental impairment, and it is closely related to, and often presents with, similar illnesses such as fibromyalgia or irritable bowel syndrome. In addition to fatigue, its symptoms include memory loss, enlarged lymph nodes, unexplained muscle pain, and headaches. The cause or causes of CFS are highly controversial, but it is closely linked to genetic, immune, viral, and psychiatric conditions. Treatment currently focuses on the psychological aspects of the illness with use of psychiatric pharmaceuticals and cognitive behavioral therapy.

CONCLUSIONS: CFS is most likely caused by the interactions of multiple factors. Treatment of the disorder should not only focus on psychiatric, but also physiological methods.
Over the years, partial nephrectomies have been increasingly shown to provide the same benefits as radical nephrectomies, by removing cancerous kidney tissue. Partial nephrectomies is associated with benefits in survival for patients regardless of tumor size, suggesting that preservation of renal function is both safe and beneficial for defense against high-risk disease. Clinical guidelines have been recommending partial nephrectomies for small renal masses, however, there are disparities that persist in the use of partial nephrectomies, including in race, gender, and hospital setting. High-volume and teaching hospitals have been associated with a greater use of partial nephrectomies than low-volume and nonteaching hospitals. Thus, it is necessary to investigate the differences in hospital preferences and outcomes in treatment of renal cell carcinoma.
Breastfeeding decreases child mortality in developing countries where alternative foods may be unsafe or unavailable. Exclusive breastfeeding for the first 6 months and continued breastfeeding up to 2 years are, therefore, recommended. To evaluate temporal changes in exclusivity and continuity of breastfeeding among under 2-year old Ugandan children by residence.

Methods
Using SAS software, we processed, analyzed, and plotted data from Uganda Demographic and Health Surveys of 1995, 2001, 2006 and 2011 involving 6,875 children. Pre-lacteal feeds were any drinks given in the 1st 3 days of life except breast milk or medicine. Current breastfeeding status was derived from number of times the child breastfed during the previous night or day, or if their age was equal to duration of breastfeeding in months. Current breastfeeding was exclusive if no other feeds were given during the preceding night and day.

Results
Overall, there was a decrease in history of pre-lacteal feeds among 0-5 month old infants from 60% (2001) to 42% (2011), though urban inhabitants started and ended at least 6 percentage points above rural inhabitants. Similar trends in pre-lacteal feeds were observed among children 6-23 months of age. Nearly 100% of infants and over 70% of one year olds were breastfeeding at the time of each survey, with lower percentages (about 60%) among 1-year old urban children and a small drop among both rural and urban children in 2011. Exclusive breastfeeding among infants <6 months decreased from 86% (2001) to 66% (2011) with city inhabitants starting 9 percentage points lower and ending 9 percentage points higher than rural children.

Conclusions
Between 2001 and 2011, there has been marked decrease in exclusive breastfeeding during the first 6 months, more so in rural than urban children. The high breastfeeding proportions into the 2nd year of life are beginning to drop. Predictors of these breastfeeding trends require investigation.
INTRODUCTION AND OBJECTIVE:
There is a strong correlation between positive surgical margins (PSM) and progression to biochemical failure after radical prostatectomy. Our objective is to identify predictors of PSM in patients undergoing multi-parametric MRI (mpMRI) of the prostate and robot-assisted laparoscopic radical prostatectomy (RALP).

METHODS:
Under an IRB-approved retrospective study, 70 treatment-naïve patients were identified who underwent a mpMRI of the prostate followed by RALP for clinically localized prostate cancer between January 2014 and December 2016. Patients included had an MRI of the prostate within one year before RALP (median of 2 months; range 0-10 months).

RESULTS:
Positive surgical margins were observed in 31 cases (44.3%). On univariate regression analysis, the following variables were independent predictors: pre-operative PSA > 10 ng/ml (OR 5.867, p= 0.002), PSA density > 0.3 (OR 3.474, p=0.031), MRI PI-RAD 5 lesions (OR 2.8 p= 0.045), extracapsular extension (ECE) (OR 4.813, p= 0.015) and PIRAD 4 or 5 lesions involving the prostate peripheral zone and transitional zone/central zone either separately or spanning these zones (OR 7.051 p= 0.008). None of the initial biopsy variables showed statistically significant prediction for PSM. Multivariate analysis revealed that ECE on MRI (OR 5.485, p= 0.028) and PSA > 10 ng/ml (OR 7.667, p= 0.002) were independent predictors for PSM after RALP. Odds Ratios (OR) were calculated at 95% CI. SPSS 24 was used in the statistical analysis.

CONCLUSIONS:
Patients with ECE identified on MRI together with high PSA > 10 ng/ml have a high risk of PSM after RALP. Extensive intraoperative dissection and a frozen section procedure may be recommended in these patients.
The ability to accurately diagnose malaria infections is of key importance in malaria control. Rapid diagnostic test (RDT) kits are used widely for malaria detection in malaria endemic regions which are resource-limited. Most RDTs target the Plasmodium falciparum Histidine-rich Protein 2 (PfHRP2), an antigen produced by P. falciparum in the trophozoite stage. RDTs, however, are not able to detect parasites with a PfHRP2 gene deletion. Furthermore, RDT sensitivity to PfHRP2 is affected by gene variations. A predictive model by Baker et al 2005, based on the types and number of amino acid repeat motifs found in PfHRP2 is effective in predicting P. falciparum sensitivity thus detectability by PfHRP2-based RDTs. In this study, the diversity of PfHRP2 gene is evaluated in two malaria endemic countries, Madagascar and Papua New Guinea. PCR detection of the PfHRP2 gene was carried out on genomic DNA from P. falciparum isolates from Madagascar and Papua New Guinea. Subsets of the PfHRP2 PCR amplicons were sequenced for the PfHRP2 gene. 18s ribosomal RNA gene PCR followed by LDR-FMA assay were also performed to detect P. falciparum infection in these isolates. Statistical analysis and the Baker predictive model were used to evaluate the detectability of P. falciparum infections by RDTs in these two countries. 2x2 contingency tables showed that P. falciparum detection by PfHRP2 gene has a sensitivity of 90.9% and a specificity of 82.6% in Madagascar and Papua New Guinea. About 10% of positive P. falciparum infections in these two countries are negative for the PfHRP2 gene. Sequence analysis revealed extensive variations in the number and arrangement of various amino acid repeat motifs encoded in the PfHRP2 genes in these two countries. The Baker predictive model suggests that 17.2% of P. falciparum infections in Madagascar (n=116) and 31.3% in Papua New Guinea (n=32) could test as false negatives by RDT.
This paper investigates how viewership of Bollywood cinema affects the construction of cultural identity among Indian American students. The study examines especially how the perceived westernization of Bollywood affects cultural identity. Bollywood cinema and music have experienced significant changes in content since its origin in the 1930s. This study argues that Indian American students are not just cognizant of these transformations but are also impacted by them, and it is based on data collected through one year of library research as well as in-depth interviews with Indian American students at Case Western Reserve University. This work contributes to the anthropological investigation of the cultural impacts of globalization especially regarding the influence of media productions on the Indian American diaspora.
Abstract

Mosquitoes (Diptera: Culicidae) are considered the most dangerous animals on Earth. This is attributed to the morbidity and mortality of the diseases they transmit (e.g. malaria, zika, yellow fever, Dengue fever, Chikungunya), which often leave their hosts dead or permanently maimed. However, it is a relatively small subgroup of mosquitos that have the capacity to transmit these diseases, and further, it is a subsample of these that are actually responsible for transmission. Additionally, sorting and identification of medically important mosquitoes from samples laden with non-target mosquitoes or other insects takes time and requires significant expertise. Therefore, it is pertinent to utilize traps that specifically target human-seeking mosquitos involved in disease transmission. An empirical review of existing methods and iterations for targeted mosquito collection includes HLC, CDC-designed traps, resting traps, barrier screens, and ovitraps. Newly emerging technologies on the frontier of mosquito collection include from passive mosquito identification using the cellphone app, Shazam for Mosquitoes, to robotic traps designed through Microsoft’s Project Premonition. Shazam for Mosquitoes will allow disease specialists to arm civilians and researchers with the ability to build distribution maps of potential disease-carrying mosquitoes in real-time at virtually no cost. Project Premonition technology could grant researchers and health officials increased capacity to actively monitor mosquito populations and disease prevalence through drone-based deployment and harvest of traps in areas facing disease outbreaks. These examples of new technology integrated with basic principles of mosquito collection and infectious disease epidemiology have the potential to transform current strategies in the fight against vector-borne disease transmission.
Glycogen storage disease type 1a (GSD1A) is a rare metabolic disease characterized by an inability to break down glycogen to release glucose from cells during fasting. The lack of endogenously released glucose causes these patients to be in constant danger of severe hypoglycemic consequences such as seizures, coma, and ultimately death. Currently there are no curative therapies, and patients rely on symptomatic treatment and a regimented diet of cornstarch to keep blood glucose at safe levels. This disease is caused by a recessive mutation in the G6PC gene leading to a deficiency of the enzyme glucose 6 phosphatase. Our goal is to combine an applicable model system and assay to use in a large scale drug screen to identify potential new treatments.

We are utilizing 2D and 3D cell culture methods with a human liver cell line (HepG2), as the liver is the primary site of malfunction in affected patients. Using CRISPR gene editing technology we have replicated patient mutations in these cells to recapitulate the disease in vitro. This model system will be tested for beneficial changes in response to drugs from a small molecule library, and used to determine feasibility of several potential routes of treatment for those affected by GSD1a.
Philos is a social robot designed for personalized interaction with individual or a group of users. The overall goal of this research project is to develop a reprogrammable robotic platform that can socially interact with humans and monitor real-time health data by enabling wireless communication between the robot and wearable sensor devices worn by individuals who require continuous monitoring and special care, such as the elderly or persons with disabilities. Building on our previous development, several technical improvements have been made. First of all, new 5-DOF arms replaced the ones with 2-DOF. Each arm has a gripper, which can be used for physical interaction with human users as well as for object manipulation. We kept the original head design with 2-DOF. These structures were actuated by servo motors, which are controlled by half-duplex serial communication with the microcontroller. Philos uses a camera and touch sensors for vision- and touch-based interaction. The system includes embedded image-processing algorithms for efficient face tracking and recognition. The touch sensor data are simply processed based on threshold values, used for distinguishing gentle vs. harsh touches. We are currently redesigning the Philos's head to diversity its facial expressions. In addition, a behavioral framework for sociable robotic systems is being studied for providing each user a personalized experience with Philos.

“Philos” focuses on developing a reprogrammable robotic platform that can socially interact with humans and monitor real-time health data by enabling wireless communication between the robot and wearable sensor devices worn by individuals who require continuous monitoring and special care, such as the elderly or persons with disabilities.
Tracheal intubation, simply referred to intubation, is a procedure in clinical treatments to secure an open airway. The procedure requires inserting an endotracheal tube (ETT) into the trachea. ETT is then connected to a ventilator or breathing machine, or sometimes even a bag used by an operator use to pump air into patient’s lung. In another words, intubation helps patients breathe if patients have difficulty breathing or is not able to breath at all. Inserting ETT into patients’ trachea accurately requires significant training and proficiency. This project aims to develop an automated intubation device based on a robotic approach.

This new device is called IntuBot. IntuBot consists of a hardware mechanism for steering a stylet through the airway which has three degrees of freedom and a vision system for automatically localizing the providing control inputs to the motors. A first prototype of the system is being constructed. Considering difficulties of testing such device on human subjects, a silicon mold of an airway model was constructed.
After working at Philips healthcare for six months I have learned multitudes about the regulations and processes involved in medical device research and development. This presentation will discuss some of the corporate structure and regulation I learned, and then delve into the projects I worked on. The foremost project was my most extensive and involved troubleshooting and then implementing a new version of a defective product. During this process I performed several different verification tests, helped write and support the service manual to implement the changes in the field, ran meetings to facilitate this process, performed separate testing to fulfill questions some design engineers had about the new design, and finally made my own changes to connector hardware based on the findings. This process is not always the same, but the general outline of how it must happen remains very uniform. My presentation will walk you through an entire defect resolution process, leaving you with a very informed idea of how the medical devices industry works on a day to day basis.
An artificial intelligence (AI) was developed capable of playing double deck euchre, a trick-taking card game similar to the more well-known game, euchre. The AI used deep neural networks and was trained with adversarial and reinforcement learning. In a reinforcement learning paradigm, a machine learns by receiving rewards, both positive and negative, and adjusts its behavior according to which of its actions produce the best reward. In an adversarial learning paradigm, a learning machine faces a learning opponent, and the two machines improve as they try to beat their opponent.

In this project, there were three deep neural networks: one for bidding, one for playing when there is a trump suit, and one for playing when there is not a trump suit. The deep neural networks were originally bootstrapped by facing a hand-crafted AI which played according to the probabilities of their cards winning. After the neural network was trained against the probabilistic AI, it competed against itself as an adversary and trained using adversarial reinforcement learning. Finally, an application was developed in order to simplify training and allow human users to play against the AI, both to evaluate the AI’s quality and for fun.
This study aims to find the connection among race, quality of life, and age and what correlations these variables have with the access of hospice and palliative care during end-stage cancer. As the cohort of older adults over the age of 65 increases rapidly, the demand for comprehensive examinations of barriers to accessing non-aggressive treatment for cancer grows as well. This combination literature review and meta-analysis first performed an initial literature search and isolated groups of relevant studies that were either measured for Cohen’s d on a random effects model or not measured for effect size. Finally, the researcher analyzed the data and drew conclusions with the coefficients drawn from both groups. This study impacts older adults who are considering hospice care or other palliative services as they approach the end of their life; there is particular emphasis placed on single, 65+ individuals without a college education, either African-American or Caucasian.
**Abstract**

High level of lead or lead ions accumulated in a human body is harmful, particularly to children. Its neurotoxic effect is profound, damaging the central and peripheral nervous systems resulting in stunted growth, behavioral problems and learning disabilities. The major source of the lead or lead ions comes from the drinking and tap water. The assessment of the water quality including the lead or lead ion content in the water is usually completed by the regional water department professional. This assessment is time-consuming and requires expensive instrument and skill operator. Therefore, there is a need to produce a simple use and relatively inexpensive method to detect lead or lead ions in water sample.

This research developed a simple-use, cost effective sensor system for the lead ions detection in tap water. Under-potential deposited bismuth sub-layer on a thin gold film based electrochemical sensor was designed, manufactured and evaluated. Differential pulse voltammetry (DPV) measuring technique was employed in this detection. Cleveland regional water district tap water of Cleveland, Ohio, USA was the test medium. Lead ions concentration in the range of 8 x 10-8 M to 8 x 10-4 M was evaluated. In this DPV detection system, it required 3 - 6 minutes to complete the detection measurement, and the longer measurement time, 6 minutes, was used for the lower lead ions concentration. The selectivity of this lead ions sensor was very good, and Fe III, Cu II, Ni II and Mg II at a concentration level of 5x10-4 M did not interfere to the lead ions measurement.
Abstract

During my co-op at the Procter & Gamble Family Care Plant in Green Bay, WI, I worked on and successfully completed six projects. One of my largest projects was to design and implement a new scoreboard system in order to more efficiently and effectively notify operators of the status of the manufacturing line. This project involved determining the best placement for each scoreboard, designing the displays, programming the displays, completing the hardware layout, and preparing all construction estimates for four separate manufacturing lines. The Green Bay Plant will likely see savings of at least $120 thousand per line per year due to the shorter amount of time it takes to repair a machine after an outage or fault when the scoreboards are used. These scoreboards are currently in the process of being installed on a line by line basis as funding becomes available. Through this project, I was able to effectively manage, execute, and lead a project that will have a positive impact on Procter & Gamble.
### Abstract

Our chemical engineering senior project focuses on producing biodiesel and designing a reactor system for the Case Western Reserve University Facilities Department in conjunction with the Office of Sustainability. Used fryer oil from Bon Appetit dining halls is converted to biodiesel. The biodiesel is produced in a transesterification reaction by combining used fryer oil and methanol in the presence a basic catalyst, potassium hydroxide. Several lab scale batches of biodiesel have been created and tested to ensure a successful reaction and high quality product. An economic analysis showed this product to be economically favorable, compared to purchasing traditional diesel. A pilot scale plant design was created. This includes a premix tank for the basic catalyst and methanol, a reaction tank with a heating element to heat used fryer oil, and distillation column to distill residual methanol from reaction byproducts. This project will help improve the sustainability of the university in multiple ways, especially as it will help decrease the waste output by the dining halls through repurposing the used fryer and decrease the amount of diesel fuel need by the Facilities Department.
Advancement of non-lethal self-defense weapons

The improvement and advancement of non-lethal self-defense weapons will hopefully help calm our restless nation that has been on edge due to the rise in police brutality and violence in recent years.

Key Words
- sustainable
- solvent
- linear polymer
- fast-evaporating

Abstract

The possibility of determining a sustainable and fast-evaporating inert solvent was explored with the goal of using the solvent as a substitute in a spray-able solution for a non-lethal self defense weapon in order to improve effectiveness. Evaluation of various solvents were screened based on flash point, vapor pressure, health and environmental concerns and economics. Due to the strict parameters, it was concluded that there was no optimal inert solvent that would be appropriate for substitution.

Additionally, the development of a sustainable and fast-evaporating linear polymer solution was qualitatively investigated with the goal of using the solution in a new product: a non-lethal self defense weapon. Various food and commercial grade starches, along with modified cellulose and surfactants, were dissolved in water at different concentrations, combinations and temperatures. Simulating the conditions under which the product would be used, each solution was pressurized and sprayed to observe the adhesive and cohesive properties, evaporation speed and residue. Ultimately, the solutions were qualitatively evaluated for their viability in the use of the new product. A handful of solutions were determined to be viable.

In order to produce a successful product, future work would involve quantitatively investigating the viable solutions. This would potentially include, but is not limited to, measuring shear rate, shear viscosity, extensional viscosity and different velocity ranges. Additionally, reconsidering the originally non-optimal inert solvents for their potential use in this new product would be part of future work.
Understanding the ultraviolet (UV) photoreaction and photoprotection mechanisms of the DNA and RNA nucleobases is vitally important for mitigating the mutagenic effects of UV radiation. Within this area, many questions surround the photophysical impacts of glycosidic bond formation. Such substitution has been shown to modulate the singlet decay and triplet population dynamics of nucleic acids. However, the low intersystem crossing yields exhibited by canonical nucleobases make it difficult to study the effects of glycosylation on triplet population by experiment, and the large sugar substituent makes the molecules very computationally expensive. Sulfur-substitution of a carbonyl oxygen drastically increases spin-orbit coupling in the nucleobases, leading to efficient population of the triplet manifold. These “thiobases” are widely popular for their clinical applications, but also provide a means to understand the impact of glycosylation on intersystem crossing dynamics in DNA and RNA nucleobases. In this presentation, the photophysics of 2-thiocytosine, 2-thiouracil, and 6-thioguanine will be discussed and compared with that of their nucleosides 2-thiocytidine, 2-thiouridine, and 6-thioguanosine, demonstrating the significant role of the sugar substituent.
The purpose of this project is to develop a program using the HoloLens that allows users to view and manipulate complex molecules such as proteins. The HoloLens uses augmented reality, also known as AR, to project virtual objects into the real world. The ability to view virtual objects in a physical environment is useful for the visualization of complex 3-dimensional structures that are normally difficult to comprehend on a 2-dimensional viewing system. AR also adds the unique advantages of preserving interactions of virtual objects with actual surroundings. This can be useful for students who are working with the molecule while still interacting with their teacher or taking lecture notes. The current program can be setup to display any protein that is registered within the protein data bank. These proteins have structures ranging from simple to complex. By using various voice commands or the virtual menu, users can interact with the molecule in several ways. Current functionalities of the program include resizing and rotating the molecule, switching between molecules, and toggling ligands on and off to visualize protein bonding sites. Additional work is being done to add further qualitative characteristics to enhance the user’s understanding of the visualized proteins.
### Abstract

Pelvic incidence is a posture independent spinal parameter that describes the summative angle created by pelvic tilt and sacral slope, which are inversely proportional. It has been linked in prior literature to sagittal imbalance and other medical pathologies pertaining to the orthopaedics of the spine. There has not been much research conducted, however, related to which specific parameters impact pelvic incidence, which is the chief focus of this comprehensive study. 120 cadaveric sacral bones were used from the Cleveland Museum of Natural History's Hamann-Todd Osteological Collection, all of which had previously been examined for pelvic incidence angles. 40 specimens were taken from each of the three qualitatively distributed groups of high, intermediate, and low pelvic incidence. Measurements conducted examined ala width and foramen number and completeness as well as sacral promontory to the inferior aspect of the 4th sacral foramen. The latter measurement was taken both with calipers and a tape measure roll. Additionally, three angles were measured about the sacroiliac joint (SI) for both sides of all specimens: The angle between sacral endplate and superior limb of SI joint articulation, the angle between the superior and inferior limbs of SI joint articulation, and the angle between the inferior limb of SI articulation and S4 segment. Results and statistical analysis at this time are still being analyzed and thus, no clear conclusions can be drawn yet. The conclusions hoped to be drawn from this study will clarify unknown pelvic and sacral parameters that could help provide physicians with a clearer understanding of an increasingly relevant spinal reference for sagittal balance and lack thereof.
Colonoscopies are routine procedures used to evaluate gastrointestinal health. Of particular interest during these procedures are adenomas, as they have been linked to gastrointestinal disorders such as colorectal cancers. However, the detection of adenomas can be occluded by peristaltic movements of the gastrointestinal (GI) tract, which occur in response to the entry of foreign objects. Peppermint oil contains the active ingredient L-menthol, which is believed to be responsible for the compound’s antispasmodic properties. A reduction in muscle spasms is thought to increase the adenoma detection rate (ADR). Eligible patients undergoing a colonoscopy received either the peppermint oil solution or a placebo in order to determine whether peppermint oil positively affects the ADR. The mechanism of action for L-menthol is discussed, as are various other gastrointestinal applications of peppermint oil. These include the use of peppermint oil as an analgesic, anti-microbial, and anti-inflammatory in conditions such as irritable bowel syndrome (IBS) or other endoscopic procedures.
When treating people with Post Traumatic Stress Disorder (PTSD), one of the biggest hurdles that clinicians face is patient dropout. Dropout rates for psychotherapeutic and pharmacological treatments for PTSD average 18.3% (Imel et al., 2013) and 30.1% (Lurie & Levine, 2010), respectively. Many people suffering from PTSD are not receiving adequate care and high dropout rates are making empirical and statistical findings from clinical trials less meaningful. Past research suggests that there may be clinical utility of quick, thin slice impressions of patients, and ratings could be used to find clients with a high risk of dropout (Sasso & Strunk, 2013). Observer ratings of brief video clips can provide reliable assessments of patient and personality characteristics (Ambady et al., 2000). This study was designed to determine whether certain, observable variables can predict early dropout from treatment using the “thin-slice” paradigm. We hypothesized that ratings of the session 1 treatment video would lead to a useful prediction of early patient dropout. Eight trained evaluators rated 60 second video clips of treatment session 1 from 131 participants diagnosed with chronic PTSD. Raters used a likert-scale from 0 (likely to drop) to 4 (unlikely to drop) to rate a “Completer” variable asking “Will this client complete the full 10 weeks of treatment?” Subsequently, patients received either prolonged exposure (PE) therapy or PE plus sertraline treatment. Rater observations of likelihood the participant will drop out of treatment did not predict dropout from either treatment (p>.05). The combination of age, sex, and education accounted for 42-62% of variance in dropout rates. Although the completer variable did not predict early dropout (before session 4) from the first session, different observable behaviors or self-report “commitment to treatment” measures could be used to effectively identify patients who are at risk for early dropout.
Abstract

Materials that are able to withstand an extreme and wide variety of stresses are desirable in the construction of medical devices such as sensors for surgery and drug delivery. The structural properties of polymers directly correlate to their ability to withstand stresses such as mechanical, chemical, oxidative, and thermal stress. We utilized thermogravimetric analysis (TGA) on several polymers to determine their structural properties since this is a more efficient method than measuring the effect of stress on a material. The first derivative peak temperature and the number of peaks and troughs in the second derivative curve provide us information about the stability and conductivity of the polymer. Based on this analysis, we found that the polymers with the most desirable properties were PEEK and polyimide. Other polymers, such as polypropylene copolymer and polyphenylene sulfide, possessed similar properties and could also be viable for the construction of sensors.

Then, we looked at the standard deflection temperatures (D648) of the polymers and compared them to that of polycarbonate, since it is commonly used in medical applications. Satisfactory substitutes will have similar characteristics as polycarbonate. Polymers that have standard deflection temperatures close to and larger than that of polycarbonate were PBT, polysulfone, and polyphenylene sulfide.

Therefore, based our TGA results and the D648 values, we recommend the use of PEEK, polyimide, polypropylene copolymer, polyphenylene sulfide, PBT, and polysulfone as alternatives to polycarbonate in medical equipment.
Makel Engineering, the NASA Glenn Research Center, and staff and students from the Mechanical and Aerospace Engineering Department at Case Western Reserve University are entering the third and final year of their partnership to develop and test a handheld air-purity sensor for firefighters. During the suppression stage - when the main fire is being extinguished - the firefighters have a Self-Contained Breathing Apparatus (SCBA) to filter any toxins or particulates in the air. However, during the overhaul phase - after the fire has been extinguished, and firefighters are looking for smaller, hidden fires - they will often remove their masks, exposing them to significant levels of toxins such as acrolein, carbon monoxide, formaldehyde, and several other hydrocarbons. Many sensors for detecting individual compounds exist; however, carrying multiple sensors weighs down the responders and limits the gasses that can be checked. The sensor design by Makel detects multiple hydrocarbons and other noxious gases at a fire site. The students were responsible for the design of the and printing of the housing. This project represents the final design iteration of the housing for the prototype sensor.

Before reception of the final fire sensor, we experimented with an existing prototype created by the previous student team to test casing design alterations intended to improve sensor grip and battery cover removal. Upon receiving the final iteration of the sensor, we altered the prototype to accommodate changes in the sensor mounting, user interface, and texturing of the cover for grip improvement. The final design implemented proven shell and mounting geometries to reduce stress concentrations and meet the required wall thicknesses for printing. The final prototype of the sensor housing was created using 3D Printing in the CWRU Thinkbox facility and integrated with the sensor components at Makel Engineering. It will be tested at the NASA Glenn Research Center in June.
One of the next major steps towards a more green future is efficient ways to store energy. One of the most promising ways to store this energy is by compressing and storing hydrogen and oxygen gas for use in fuel cells. However, fuel cells are a relatively new technology, and a better understanding of the potential throughout the fuel cell is required to take full advantage of their energy storage. A step in the right direction is to be able to model the ion flow within batteries and fuel cells using the physical equations that govern the motion of charged particles. A complete understanding of the potential throughout the electrolyte of a fuel cell will allow the cells to be designed for the maximum possible power to be drawn from the reaction of hydrogen and oxygen gas. I examined the transport equations that govern the motion of ions through a solution. Specifically using the Nernst-Planck, Poisson-Boltzmann, and Butler-Volmer equations where they are applicable to find the potential throughout the membrane of a fuel cell.
As underground infrastructure ages, natural gas pipelines are more susceptible to gas leaks, resulting in severe consequences with a lack of appropriate provisions. Stemming from the resultant incidents of fire, explosion, and toxic exposure, community risks associated with natural gas release are economic loss, human health issues including loss of life, and environmental disruptions. The primary purpose of this research is to characterize these consequences in different real-life scenarios and

As most of national pipelines age, pipeline failures becomes a new critical hazard in modern society. Whereas the causes of the pipeline damage are identified, our communities are still vulnerable to the resultant incidents such as fires, explosions, and toxic exposure due to the challenges with monitoring underground pipeline damage and detecting abnormal natural gas (NG) release. This proposed research examines the possible consequences at the community level caused by NG release as the first step in determining how risk can be mitigated or prevented. The overarching community risks associated with NG release are economic loss, human health issues including loss of life, and environmental disruptions. The consequences of five major incidents are investigated in this research. NG explosions and subsequent fires due to underground piping failure brought about tens of housing and multi-story building collapse with dozens of casualties in populated communities in CA (2010) and NYC (2014). It was also observed that a NG pipeline failure incident in a rural area resulted in far-reaching losses in terms of the economy and environment from the Colonial Pipeline explosion in Alabama (2016), resulting in oil and gas shortages along the East Coast, water contamination, and forest fires. Similarly, a gas leak in Southern California (2017) harmed the environment and local health. Lastly, the need for further studies on gas explosions exhibiting distinct features from standard TNT explosions was magnified after the Buncefield explosion in UK (2005).

This research on various consequences associated with NG release aims to quantify risks of underground NG pipeline failure induced hazards. Comprehensive understanding of the individual and community risks will enable the development of appropriate risk management methodologies, with the goal of mitigating the hazards and risks of NG pipeline failure.
Exploring the role of Casz1 in T helper cell cytokines - possible implication in oral infections

Abstract

Casz1 has been identified as a critical protein in the development of mammalian cardiac cells, tissue morphogenesis, vascular assembly development, neural development and has been increasingly studied for its tumor suppressor activity. T-cells are immune cells that initiate activation of the immunological response through the presentation of antigens on major histocompatibility complex, MHC. A recently identified T-helper cell type is Th17, so named because of the secretion of IL-17. Th17 cells are directly related to autoimmunity and the clearing of fungi infections with the interleukins they synthesize and secrete - IL-17A and IL-22. Recent findings in Dr. Pandiyan’s laboratory revealed a direct relationship between Casz1 and IL-17A in vitro and in vivo. This project aimed at examining the correlation between Casz1 and cytokines, using Casz1 heterozygous alleles and deficient (knockout) CD4 T cells. We cultured CD4+ naïve T-cells under Th17 differentiation conditions and validated the levels of Casz1 and Th17 related cytokine genes. The expression of Casz1 mRNA correlated to Th17 differentiation, which is indicated by the direct marked increase of IL17A and consistent expression of Casz1 at days 2 and 4 of TH17 cellular differentiation. This was not seen in Casz1 knockout cells.
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Abstract

Purpose: Sprouting angiogenesis is the growth of new vessels from existing blood vessels. By studying this process, we can learn the specific functions of angiogenic genes. Hypoxia (low oxygen levels) through the activation of the Hypoxia Inducible Factor (HIF) is known to influence angiogenesis. This study focused on determining how hypoxia influences Notch signals which direct sprouting angiogenesis involving specialized tip endothelial cells (ECs) responding to vascular endothelial growth factor (VEGF-A). These molecular processes can help in the understanding of angiogenic diseases, such as cancer, and devising new targets for their treatment.

Procedure: The mouse retina system was used to examine how the in vivo genetic loss of HIF in endothelial cells affects sprouting angiogenesis using fluorescent lectin to image vessels in retinal explants. In addition, the transcriptional activity in the mouse endothelial MS1 line in response to the effects of hypoxia, inhibition of Notch signaling, and the influence of Notch ligands (Dll4/Jag-1) was assessed by real time quantitative-PCR (qPCR).

Data Analysis: Our results show that growth of blood vessels is reduced in retinas of HIF-1beta endothelial deficient mice. In addition, sprouting EC numbers are decreased in mutant mice. Our qPCR analysis demonstrates changes in the expression of VEGF Receptors (Flk1, Flt1), Notch ligands (Dll4, Jag1), and the downstream Notch targets (Hrt1, Hrt2). Ligand stimulation further affects the expression of Flk1, Dll4, and Hrt2. Notch inhibition with gamma-secretase inhibitor DAPT, results in additional altered expression of the various genes involved in sprouting of tip ECs.

Conclusion: Our results demonstrate that 1) loss of endothelial-HIF results in reduced retinal endothelial sprouting and overall vessel numbers, 2) hypoxia leads to changes in genes involved in sprouting angiogenesis and 3) loss of Notch affects the expression of hypoxic regulated genes.
The role of women has changed from the beginning of time to the current world. As Chu and Yu (2010) explain, in China, women had been subjected to discrimination and gender prejudice where men were regarded as the superior complex. Therefore, women in traditional China were valued less by their society, and they could not have done much. For instance, sons were more cherished by their parents at birth, and a birth of a daughter was received with minimal or no happiness. Similarly, the life of a girl was determined at birth because many families wanted the first born to be boys. A girl was termed unlucky because the society believed that only boys could help their family when they get old (Chu & Yu, 2010). Therefore, women in the old traditional China had fewer roles and rights compared to the current world where women have become feminists, and the societies have started recognizing their worth.

The research project proposes the expansion of the study of Chinese cultural and traditional beliefs in the context of women and their roles as well as their contribution to the society at different stages starting with the traditional phase, liberation phase, and the current or modern phase. Therefore, the study would provide the relevant information regarding the roles and responsibilities of women in all the phases and the steps that led to the liberation of women from communism and male domination. Additionally, the report would incorporate the changes of legislation that helped in the changing of women’s responsibilities; hence, seeing the development and expansion of China economy.
**Title**: ARMS-I: A Novel Antiviral With Dual Action Mechanism Against Influenza

**Abstract**

BACKGROUND: Viral Upper Respiratory Tract Infections are responsible for complications of substantial morbidity and mortality around the world costing over $100 billion each year. Available treatment and prevention strategies using vaccines have multiple shortcomings, which create a growing need for developing new drugs that target a wider spectrum of viruses.

PURPOSE / HYPOTHESIS: ARMS-I, a first-in-class oral topical drug spray formulation, is designed to disrupt infections through a dual mechanism of direct virucidal activity and barrier formation preventing viral contact, binding, and invasion into host mucosal tissues.

METHODS: The antiviral activity and barrier components (via glycerin, and xanthan gum) of ARMS-I were tested separately using RSV (in A549 cells) and Influenza A/B (in MDCK cells). For each concentration of virus tested, a different concentration of ARMS-I was evaluated. Transmission Electron Microscopy (TEM) was used to determine the effect that ARMS-I had on viral ultrastructures.

RESULTS: Virus treated with as little as 1.5% ARMS-I had a 2 log reduction in the viral titer compared to control treatments. The barrier treatments that contained >25% of ARMS-I barrier components showed a >2 log reduction in the viral titer by the TCID50 compared to control treatments. There was no damage to the cells (cytopathic activity) and no presence of the virus by immunofluorescence staining and cell viability. Results from the TEM examination revealed ARMS-I disrupted the viral envelope and its morphology.

CONCLUSIONS: The data collected shows that ARMS-I is a novel class of drug that is virucidal and has barrier activity against viruses responsible for upper respiratory tract infections.
Although associations of sleep disordered breathing (SDB) and continuous atrial fibrillation (AF) have been well-characterized, the relationship of SDB and paroxysmal AF (PAF), an earlier stage in the AF evolution, is not well understood. We sought to examine the association of SDB and its attendant pathophysiologic attributes in relation to PAF. Conditional logistic regression models were used to assess relationships of SDB measures and PAF. Multivariable models were further adjusted for hypertension, diabetes, myocardial infarction history, dyslipidemia and depression (odds ratio and 95% confidence intervals presented). The analytic sample was comprised of 300 participants (n=150 cases, n=150 controls): age 61.9±11.9 years, 63.3% male, and BMI 31.4±6.7kg/m2. Unadjusted analyses demonstrate a statistically significant inverse association of AHI and PAF (OR=0.95, 95%CI: 0.93-0.97) which persisted in the multivariable model (OR=0.95, 95%CI: 0.93-0.98). High blood pressure had a significant association with PAF (OR= 1.97, 95%CI: 1.013-3.82). No significant associations were observed for CAI, AI and TST<90 relative to PAF. The current findings demonstrate a 5% decreased odds of PAF per single unit increase in AHI consistent with an unanticipated inverse association. Given existing data showing increased risk of mainly continuous AF in SDB, it is possible that SDB may exert variable influences (beneficial versus detrimental) depending upon the extent of cardiac remodeling and stage of AF evolution.
**Purpose**
To study which and how project management methodologies are being taught to mechanical engineering students.

**Approach**
The study began by reviewing literature on both Traditional Project Management (TPM) and Agile Project Management (APM) methodologies. This review ended with characteristic pairs of methodologies that could be compared against each other for the sake of measuring student understanding of the techniques chosen. A survey study design is adopted and sent to large groups of the Case Western Reserve University student body to develop a quantitative data set. Patterns from the survey were identified and compared against developed benchmarks to draw conclusions on which methodologies were being applied and how effectively they were being used. Since APM is supposed to deal with the problems of TPM in complex environments, TPM and APM education is assessed to see if APM is educated in a formal setting or if it is self-taught and if so is it being properly applied.

**Predicted Findings**
The findings indicate that TPM is heavily taught in mechanical engineering settings and APM is essentially overlooked. However it has been found that students who have served in a managerial role are more likely to understand, although still not apply standard APM techniques.

**Research Limitations**
The limited number of students who took the survey for this research is the primary issue that limits this study. Since subject came from one university it cannot be used as an overall generalization. However, it is hoped that this work will serve as a basis for further research.

**Predicted Practical Implications**
The study shows that while TPM will continue to be taught due to straightforward nature of mechanical engineering projects in
A promising new therapy consists in reactivating tumor suppressors, which are commonly inactivated in tumors to promote their growth. PP2A, also known as Protein Phosphatase-2A, is a tumor suppressor that regulates many cellular processes by dephosphorylating target proteins. When this enzyme is inactivated, it allows cancer cells to divide uncontrollably. Hence, reactivation of PP2A will lead to dephosphorylation of tumor-promoting proteins such as AKT, ERK, and MYC. The Narla lab has developed a series of small molecule activators of PP2A, abbreviated SMAP, that can cause cell death in myc-amplified patient derived tumors, which were implanted into the mice. We hypothesize that reactivating PP2A in lung cancer cells in mice would decrease the growth rate of the tumor. We propose to test this hypothesis by determining the efficacy of reactivating PP2A in a mice harboring patient derived tumors and investigating whether the effect observed after treatment with SMAPs is driven by the dephosphorylation of PP2A target proteins such as Myc. Tumors harboring a myc amplification derived from a patient with lung cancer were surgically implanted in mice. Once the tumor size reached 100 mm3, the mice were randomly assigned to vehicle control or SMAP treatment or to a kinase inhibitor combination treatment that targets the pathways modulated by PP2A. At the end of the study mentioned in aim 1, mice were sacrificed and the tumor tissue collected. Proteins were extracted and levels of phosphorylated proteins to total proteins were compared between treated and untreated tumors. We also gathered the liver and serum of these mice as a measure of toxicity and the bioavailability of SMAP in the blood, respectively. Our results show that while SMAP did not affect the phosphorylation of AKT and ERK, it led to the degradation of Myc: a major driver of tumorigenesis. Our results highlight the efficacy of reactivating PP2A in the context of myc amplified tumors.
Background: Self-disclosure in friendships has been shown to buffer against depression in adolescents (Adams et al., 2012). Keeping secrets from best friends (Laird et al., 2013) has been associated with depression in adolescents.

Methods: The study evaluated 81 adolescent inpatients, ages 12-17. Self-reported levels of depression were assessed using the Children’s Depression Inventory (CDI; Masip et al., 2010). Interview questions were used to assess social networking, by evaluating if subjects spent time with a close friend within the past month, and social support, by assessing if subjects shared personal problems with friends.

Results: Social networking and social support were both assessed at three levels: infrequently, frequently, and always. A 3X3 ANOVA was used to assess between-group differences in self-reported levels of depression based on the CDI associated with social networking and social support. There was a significant main effect of social networking, F(2, 70)=3.65, p=0.03, partial eta squared=0.09. Subjects who reported always engaging in social networking had the highest level of depression (M=43.87, SD=12.41), relative to frequently (M=42.08, SD=11.14) or infrequently (M=39.0, SD=9.19). There was a significant main effect of social support, F(2, 70)=4.09, p=0.02, partial eta squared=0.10. There were significantly higher depression scores among the group who used social support frequently (M=46.86, SD=11.99) as compared to always (M=38.23, SD=10.42) and infrequently (M=42.47, SD=9.91).

Discussion: Higher levels of social networking were associated with higher depression scores. Subjects who reported moderate levels of social support had higher levels of depression than those with high or low levels of social support. These results may indicate that social networking may not buffer against depression if there is a lack of self-disclosure in friendships. Limited statistical power because of the small sample size may limit the significance of some results.
Title

Mosquito-Inspired Insertion Guide Prevents Flexible Intracortical Microelectrodes from Buckling during Implantation

Elevator Speech

An insertion guide for flexible microelectrodes which increases the rate of successful implantation and reduces buckling has significant implications for the field of neural engineering. Taking inspiration from the mosquito bite, this innovation can help bring brain-computer technologies including neuroprosthetics to fruition - ultimately improving the quality of life for many.

Key Words

Biomimicry
Brain-Computer Interfaces
Neural Recording Electrodes
Neural Engineering
Functional Electrical Stimulation

Abstract

Intracortical microelectrodes are essential tools in the rapidly growing brain-computer interface (BCI) and brain-machine interface (BMI) fields. The development of flexible intracortical microelectrodes has been a priority for researchers in efforts to increase biocompatibility and recording performance. A problem that arises, however, is that during implantation these flexible probes must remain stiff enough to penetrate the brain tissue without buckling. Looking to nature, the mechanics behind the mosquito bite allow its fascicle, a flexible tube merely 30 microns in diameter, to be inserted into the human skin. This study details the development of a mosquito-inspired assistive insertion system which significantly increases the rate of successful implantation and drastically reduces buckling. Experimentation with laser-cut insertion guides in an agar gel model of the brain revealed that the guides enabled the insertion of flexible probes that otherwise buckled and/or deflected off the surface of the agar gel. In particular, successful insertion was achieved in 92% of the trials with the guide (versus 23% without). Buckling only occurred in 19% of the trials with the guide (versus 85% without). Furthermore, in vivo experimentation demonstrated the ability to implant a flexible microelectrode through the intact dura mater of the rat brain using the insertion guide. Finally, compression force testing demonstrated an approximately 300% increase in the critical buckling force of the microelectrodes when utilizing the guide. The results suggest the feasibility of the insertion guide to greatly increase the probability of successful implantation of flexible microelectrodes in brain tissue.
Affinity-mediated medication delivery utilizes interactions between medication molecules and a delivery system to extend the rate of drug release and improve treatment. Cyclodextrin, a basket-shaped molecule that can be polymerized into different forms, is a promising affinity drug delivery system due to its versatility and ability to bind to hydrophobic drugs. Affinity testing for various medications is a time-consuming process, creating the need for a virtual model. The most popular methods for determining affinity have been docking algorithms and statistical models; the effectiveness and suitability of both were analyzed in this project. To start, the experimental binding affinities of 1500 molecules were collected from publicly available research. The docking program PyRx was used to calculate binding affinities for these molecules and model potential binding configurations. Various chemical descriptors were analyzed with PaDEL-Descriptor in order to create a statistical model. Analysis using different factors adjustable in PyRx, such as energy calculation algorithms and the molecular force field, did not yield significant differences in predictive capacity. Furthermore, the predictiveness of docking algorithms underperformed the predictive capacity of published models, yielding an R2 value of 0.13. R2 measures predictiveness of a model compared with data; an R2 of 1 indicates a perfect fit. Current attempts to create a linear model using chemical descriptors have yielded a percent deviation from experimental values of 18%, though R2 cannot be calculated at this time. Though not capable of being used as reliable predictors yet, these results serve as a base to launch further refinement of the virtual model for the prediction of binding affinities.
Evidence that Force and Adhesive Proteins Influence Cardiac Cell Orientation

The human heart physically adapts to the demands of blood flow associated with lifestyle, aging and disease, for example, consider higher demands for both a marathoner and a life-long couch potato. Here, we aim to learn how the adaptations of the heart with aging and cardiovascular disease are tunable.

The heart responds to chronic challenges such as normal growth and disease by remodeling the shape of the organ. Cardiac fibroblasts are considered the main architects of the hearts scaffolding and primarily produce extracellular matrix proteins. While limited prediction of morphological changes is possible, a lot is still unknown about the combined effects of mechanical and biochemical signals on remodeling. We conducted a literature review on published studies to analyze the role of cell orientation, adhesive proteins, and mechanical force on remodeling activity of cardiac fibroblasts. Fibroblasts maintain the structure of the heart by altering orientation and matrix production in response to external stimuli. In the setting of injury, fibroblasts substantially increase the production of collagen when exposed to physical forces. These fibroblasts are characterized by differentiation into myofibroblasts which form fibrosis and scarring. Several research groups successfully modeled the fibrotic switch in the cell culture dish by exposing fibroblast to different stressors including biochemical cues, and varying mechanical forces such as cyclic load and matrix-stiffness. Given the gradations in the fibroblast injury response with aging, we anticipate that the sensitivity of fibroblasts to the injury state is influenced by the protein composition of the extracellular matrix. In this literature survey, I categorized peer-reviewed published experiments based on: experimental mechanical load, cell type, protein substrate, orientation response, and differentiation response. The consolidated data suggests intrinsic differences in fibroblasts from different tissues and from primary isolated cells compared to cell lines. The data also leaves open questions about whether age- and disease-associated changes in the local environment alter the sensitivity of fibroblasts to the fibrotic switch. We discuss future experiments to address these open questions.
Analysis and Targeted Drug Treatment for GSD-1a

Glycogen Storage Disease Type 1a (GSD1a) is an autosomal recessive disorder caused by a mutation in the glucose-6-phosphatase gene, G6PC. Because G6PC encodes the enzyme glucose-6-phosphatase (G6Pase), mutations in this gene inhibit glycogenolysis, thus preventing individuals with this disorder from efficiently breaking down glycogen and utilizing glucose. However, there are currently no long term treatments or cures for this disease. In order to address this obstacle, we will better characterize GSD1a by developing a more accurate cellular model for the disease through culturing three-dimensional HepG2 liver spheroids, which will mimic GSD1a’s behavior in vivo. We will subsequently perform several assays using this model in order to develop an effective treatment for this disease. With the results of these experiments having been obtained, we will investigate possible cures to the disease via blind and informed drug tests along with further research into the role of a gene similar to G6PC, G6PC3, in the glycogenolysis pathways.
The metabolic syndrome (MetS) is a combination of certain glucose and lipid metabolism-related factors for Type II diabetes, cardiovascular disease (CVD), stroke, and kidney disease. More specifically, it is characterized by metabolic factors that consist of the following: abdominal obesity, elevated blood pressure, elevated fasting glucose, high triglycerides (TG), and low high-density lipoprotein cholesterol (HDL-C) levels. This secondary analysis of a chronic stress study was carried out to determine the prevalence of metabolic syndrome factors among a small group of older African American adults in the Cleveland community. Fasting blood samples were taken for measuring TG, HDL-C, and hemoglobin A1c. Along with hip and waist measurements and blood pressure measurements. Based on the data collected it can be proposed that the A1c and waist circumference were the most prevalent metabolic syndrome factors among this sample size.
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**Elevator Speech**
Community Based Participatory Research is a partnered approach to research that involves community representatives, organizations, and researchers equitably participating in all aspects of the research process. The goal is to increase understanding of specific problems and to integrate that knowledge interventions, policy, and social change to improve health and quality of life for the community.

**Key Words**
- IRB
- Community Based Participatory Members
- Unaffiliated Members
- Community Members on IRBs
- History of IRBs

**Abstract**
In 1974, the Department of Health Education and Welfare promulgated the regulations on the Protection of Human Subjects that established the Institutional Review Boards (IRB). It is the responsibility of the IRB to review research protocols involving human participants to ensure that the rights of the participants are protected, that they are not subject to unreasonable harm (physical and emotional), and that information about them is kept confidential. This poster focuses on the history and evolution of IRBs highlighting the importance and goals of Community Based Participatory Research (CBPR). CBPR begins in the local community as a mean to partner the local community in research. CBPR goals include understanding issues important to the community, supporting research and translating findings to interventions within that same community.
We developed the Reflexion Edge, a patent pending, two by six foot touchscreen that collapses into duffle bag and deploys in minutes. With a weekly 30 second test where athletes interact with light patterns in front of them we can monitor many important factors in detecting concussions simultaneously.
Neuronal survival is regulated by many signaling pathways in vertebrate and invertebrate nervous systems. In Drosophila, Toll-like receptor pathway members, Toll-6 and Toll-7, are known to have neuroprotective roles. However, neither the downstream effectors of Toll signaling nor the cells within which they function to promote neuronal survival have been defined. We recently found that Toll-6 signals through the TIR-adaptor protein dSARM and the FoxO transcription factor to regulate motoneuronal function. Therefore, we asked if dSARM and FoxO are downstream mediators of Toll-6's neuroprotective functions. We find that Toll-6, dSARM, and FoxO likely cooperate to promote survival of motoneurons and interneurons, but not glia, in the embryonic nervous system. To uncover the specific cell type in which these interactions occur, we knocked down Toll-6, dSARM, and FoxO in glia or neurons and quantified neuronal survival. Surprisingly, this pathway appears to function in glia to promote neuronal survival. Vertebrate glia have well defined roles in regulating neuronal number, yet the neuroprotective functions of Drosophila glia are largely unknown. Therefore, our data provide evidence that a Toll-6 signaling pathway acts in glia to promote embryonic neuronal survival.
### Abstract

This project researches past efforts to address homelessness in Los Angeles, CA over the past approximately 25 years (from 1990-2016). The similarities and differences in how federal and local government has perceived and addressed problems and solutions relating to homelessness are compared against those of a local nonprofit faith-based mission, the Union Rescue Mission. A broad scale public policy analysis is conducted, identifying the shift from a “Supportive Services” public policy focus to the recent “Housing First” focus. It is argued that the gap between the two parties hinders effective progress, and has grown larger over the years. Despite the unparalleled support faith-based missions have provided to people experiencing homelessness, they have been stigmatized, under appreciated, and underfunded. In order to be most successful in their efforts to end homelessness, the two parties need to collaborate closely, viewing their approaches as complementary rather than conflicting.
The Planck satellite has been used recently to measure the temperature of the Cosmic Microwave Background (CMB) to very high precision. Analysis of this data has identified a curiously low variance in the temperature compared against predictions by the prevailing theory, Lambda CDM. This discrepancy is strongest in the northern ecliptic hemisphere, with the southern ecliptic hemisphere matching theory very well. However, this anomaly is not significant enough to be noteworthy in its own right; additional data independent of what is currently on hand is needed to make a stronger statement about the "reality" of this anomaly.

A primary focus of this project is to identify an analysis technique which may be used on future data to confirm or refute the existence of this anomaly. A secondary focus is to determine how dependent this anomaly is on the analysis technique. In order to accomplish both of these, we numerically analyze a spherical harmonic transform of the data at different resolutions (maximum l). We find that the significance of the anomaly is generally constant for most analysis techniques we tested.

A possible discrepancy between observations and theory of the cosmic microwave background temperature may indicate that isotropy, a fundamental assumption used in much astronomy and cosmology research, is not generally true. We are trying to prepare for observations that will either confirm or refute the existence of this discrepancy.
Abstract

Parkinson's disease (PD) is a neurodegenerative disease. Mutations in a protein kinase, LRRK2, are the most common causes of familial PD. Previous studies have shown that LRRK2 directly phosphorylates the T73 residue in RAB10, a member of Ras GTPase family. However, it is unknown whether RAB10 phosphorylation alters neuronal function. RAB-10 of C. elegans is a close homolog of the human RAB10 and it is critical for the integrity of neurite structure in neurons including the PVD neuron. The PVD neuron is a nociceptor covering most of the worm body, with extensive neurite branching that consists of primary (1º), secondary (2º), tertiary (3º) and quaternary (4º) neurites. We have examined the neuronal effects of phosphorylation of the T73 residue by LRRK2 through examining the phosphomimetic (T73E, T73D) and nonphosphorylatable (T73V, T73A) mutants of rab-10. T73 mutations are introduced into the endogenous rab-10 locus using CRISPR-Cas9 technology. Using a GFP tagged nematode line, PVD neurite structure is examined by fluorescence microscopy. Data is recorded by counting individual neurites 100 µm anterior and posterior to the cell body in adult worms. Neuronal function is tested through harsh touch, in which mutant worms are mechanically touched in either the posterior or anterior body areas. Response to touch, as well as backward and forward movement is observed. Our experimental results show that nonphosphorylatable mutants are morphologically similar and respond to harsh touch similarly to wild type worms. The wild type strain had an average of 2.5 2º, 3.9 3º, and 5.0 4º posterior neurites, while nonphosphorylatable mutants had an average of 2.6 2º, 3.7 3º, and 0.2 4º neurites. Phosphomimetic strains had an average of 1.2 2º, 0.2 3º, and 0 4º neurites. In conclusion, phosphorylation of RAB-10 leads to severe neurite loss. Our findings suggest that RAB10 phosphorylation by LRRK2 may cause neuronal defects, thus providing useful insights into PD pathogenesis.
**Organic Corrosion Inhibitors in Waterborne Paint Coatings**

Corrosion is an extensive and costly threat to infrastructure and technology commonly addressed with techniques such as protective coatings. As environmental awareness progresses, traditional inorganic coatings are ceding to organic waterborne alternatives. The corrosion resistance of two organic inhibitors in acrylic water-based paints were determined through electrochemical measurements, spectroscopy, and microscopy. Carbon steel substrates were coated with various concentrations of the organic inhibitors H650 and H570. Electrochemical measurements were performed on coated substrates using 5% NaCl as an electrolyte. After an hour, open-circuit potential (OCP) showed that the potential differences between the substrate surface and reference electrode (EOCP) of H570 and H650 coated steel approached -0.1 V and stabilized around -0.3 V after starting around -0.2 V to -0.15 V. This suggested a passive layer was formed by the organic inhibitors and slowed electrolyte movement across the coating. Electrochemical impedance spectroscopy (EIS) discerned increased charge-transfer resistance (RCT) with increasing concentrations of inhibitor, peaking at 98% protection efficiency in a concentration of 5% H570. After three weeks immersed in 5% NaCl solution, Attenuated Total Reflectance-Infrared and Raman Spectroscopy displayed magnetite peaks characteristic of corrosion on pure steel substrates and found the degradation of water-based paint peaks in substrates without inhibitors. Overall, H570 and H650 additives performed more proficiently than uncoated carbon steel and water-based-paint without additives, with 5% H570 displaying peak performance. Thus, organic corrosion inhibitors in waterborne paints improve corrosion resistance and paint stability, varying with concentration.
Modeling Ligase 4 Syndrome Using Induced Pluripotent Stem Cells and Cerebral Organoids

Ligase 4 Syndrome is a severe genetic DNA-repair disorder, where patients have a small head size (microcephaly), are intellectually delayed, and are prone to multiple cancers. Our preliminary results show that microcephaly is caused by increased cell death of newborn neurons, thus defining potential treatment option(s) for patients with this disorder.

Abstract

Ligase 4 Syndrome is a genetic disorder that causes congenital microcephaly, a severe condition where a baby is born with a small head size; this disease can be life-threatening and is often associated with a host of neurological problems such as developmental delay, brain structure abnormalities and intellectual disabilities. Ligase 4 protein is essential to one of the DNA repair mechanisms, the Non Homologous End Joining pathway (NHEJ). LIG4 deficiency is detrimental to proper neurological development at the very start of embryogenesis. Due to lack of proper models, Ligase 4 Syndrome related microcephaly is not completely understood. This study seeks to uncover the pathogenesis of LIG4-induced microcephaly, specifically by tracking the behavior of stem cells during neuronal differentiation to identify which population of cells is mainly affected and at what stage. We used cerebral organoids, a recently developed human model that is generated using induced pluripotent stem cells (iPSC) derived from patient and control cells. Using immunofluorescence staining and confocal imaging, we were able to differentiate and track the neuronal cell populations in cryosectioned cerebral organoids, allowing us to compare their proliferation and localization of distinct cell populations between patient and control cell lines. In order to discriminate the genomic background effect, we produced isogenic cell lines using the CRISPR/Cas9 genome editing technique. We found that in the LIG4 cerebral organoids the number of newborn neurons was increased cell death, specifically affecting newly differentiated neurons. We believe this is primarily because the new neuron population relies mostly on NHEJ in order to repair damaged DNA. Further confirmation of our results is needed through corroboration from isogenic cell line data with cerebral organoids. Better understanding of the mechanism of LIG4-induced microcephaly could lead to better therapeutic options for LIG4 patients.
Many areas around the globe lack the infrastructure or income for basic electrical infrastructure. A specific example are countries in Sub-Saharan Africa, such as Rwanda. Our solution to this ongoing problem is a low-cost, portable, and efficient crank generator. Outfitted with a clutch, a foot pedal, and a gear system, the user is able to provide mechanical input and produce high electrical output. With the foot pedal positioned to be moved by the heel of the user's foot, the user is able to input mechanical energy more comfortably and for longer periods of time than other user-driven crank generators. Our design provides an innovative design while also keeping cost and the needs and limitations of the end-user in mind.
This project features an analysis of both depression and eating disorders (and their subcategories) in terms of cultural subjectivity and the employment of gender in social disease construction. I explore how cultural conceptions of both depression and eating disorders are integrally linked with conceptions of gender. As a vantage point from which one can examine transformations in socialization and behavior, values and philosophical thought, and health and medicine, gender is critically instrumental in understanding both depression and eating disorders from a cross-cultural perspective. The embedding of gender in the primary conceptualizations of both these diseases, then, creates a wealth of opportunity for a critical analysis of the culturally-based etiologies, diagnostic systems, treatment options, and, therefore, individual experiences of both depression and eating disorders. In order to achieve this analysis, I use writings from the fields of medical anthropology, psychiatry, psychology, and medical rhetoric—to name a few. I draw upon the cross-cultural interpretations of these diseases from the position of globalization. As the world becomes increasingly interconnected, so too do our notions of illness and gender become intertwined—though some elements remain distinct in notable ways. I discuss the current models of intervention and treatment; how gendered ideals—of illness, emotionality, and the medical self—affect treatment experiences as well as the dynamics of patient-physician interactions. My hope is to illuminate how the current gendered approach to understanding these diseases can be limiting. A more holistic view of the complex interplay between culture, biology, and self in the realities of depression and eating disorders can aid us as we attempt to improve the biomedical treatment for common mental illnesses.
The impact of Japanese Popular Culture such as Anime and Manga on Japanese Language Learning & Acquisition in the U.S.

Abstract

Statistics have shown that Japanese foreign language (JFL) students in the United States and around the world are increasingly motivated to learn Japanese because of their interests in Japanese popular culture such as anime and manga. During their Japanese language learning experience, JFL students consider anime and manga rather helpful, especially in acquiring proper listening comprehension and pronunciation. Many instructors, however, have reservations about anime and manga as cultural and linguistic examples and express concerns about their impacts on student's Japanese language learning and acquisition. This study is based on a library research on relevant academic sources addressing the impacts of popular culture on Japanese Language Learning and acquisition as well as ethnographic interviews with JFL students and instructors at Case Western Reserve University. The focus of this study is to investigate how students and instructors view and incorporate anime and manga as potential learning materials as well as the possible impacts of these productions on students learning experiences, the classroom dynamics, as well instructors teaching strategies.
Glioblastoma (GBM) is the most common and malignant primary brain tumor and contains self-renewing, tumorigenic cancer stem cells (CSCs) that contribute to tumor initiation and therapeutic resistance. The starting point of this stem cell is EGFR that is critical in CSC maintenance and for therapeutic purposes. This experiment attempts to figure out another CSC receptor, p75NTR can support and help EGFR function when EGFR is blocked or inhibited.

Glioblastoma is the most common and malignant primary brain tumor and contains self-renewing, tumorigenic cancer stem cells (CSCs) that contribute to tumor initiation and therapeutic resistance (Lathia, 2015). Growth factor signaling was discovered to be essential in CSC maintenance. Epidermal growth factor (EGF) binds to epidermal growth factor receptor (EGFR) that is targeted for therapeutic purposes because it activates majority of GBM CSCs. Nerve growth factor (NGF) and brain-derived neurotrophic factor (BDNF) bind to p75 neurotrophin receptor (NTR) that does not have kinase, which phosphorylate other targets and simply receive signals.

The primary objective of this experiment is to determine physical relationship between two receptors that are embedded in CSC membranes, EGFR and p75NTR, and their contribution to therapeutic resistance. In previous experiments, it was proved that there was a correlation between EGFR and p75NTR when EGFR was inhibited by erlotinib, an EGFR inhibitor (unpublished). In order to determine the physical connection between two receptors, LM 11-A31 was utilized to stimulate p75NTR. We conducted two approaches to determine the physical relationships. For the experiment, we mainly used erlotinib to suppress EGFR activity and was able to observe some expression was reawakened by addition of LM. After developing the result from the Western blot, we hope to observe some mixture of p75NTR in EGFR which indicates that there is not only a common downstream effector for stem cell maintenance and therapeutic resistance but also physical relationships between two essential receptors. If the physical relationships are confirmed between receptors, p75NTR can be heavily dependent to support EGFR when EGFR is blocked or inhibited.
Detecting and treating hearing loss in children is critical to help them acquire normal speech and language. In the clinic, people are often asked to repeat back words or sentences that are presented in noise. Based on their performance, clinicians can estimate the person’s daily difficulty in understanding speech in noisy environments. Sentences are valuable tools to test a person’s ability to recognize speech because they are most similar to what people listen to throughout the day. Currently, there is a need for sentence materials appropriate for use with a pediatric population. Over the past two years, our lab created a corpus of 400 sentences, separated into 20 lists (20 sentences/list, 4 keywords/sentence). We assessed four features to equalize list difficulty within the corpus: keyword frequency, number of syllables/keyword, syntax structures of the sentences, and number of fricative/affricate speech sounds (high frequency sounds). It is important to ensure that lists are equal in difficulty so that, when used separately, listeners’ responses are based on their auditory ability and not on differences in content. Initial testing of the corpus indicated that lists differed in difficulty. The corpus was then retested on 20 adult participants in order to pinpoint which sentences contributed to list inequality. Identifying sentences that differ in difficulty will allow us to adjust the intensity of each sentence in order to equalize difficulty between lists. This new corpus will be retested on children to ensure equal list difficulty after all level adjustments have been finalized.
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**Title**

*Effects of miR-29b-1-3p and miR-29b-1-5p on osteogenesis of hMSCs co-encapsulated in novel polymer hydrogels*

**Author Status**

Case Western Reserve University

**In Graduate Student Competition**

True

**Category**

Biomedical Engineering (CSE)

**Published?**

False

**Presentation Type**

Poster

**Key Words**

Hydrogel

microRNA delivery

Osteogenic differentiation

**Abstract**
Each year, in the US alone more than 2,000 infants between birth and 1 year of age succumb to Sudden Infant Death Syndrome (SIDS), the unexplained and sudden death of infants during their sleep. Although there are many counteractive measures used there is still no known way to prevent SIDS. The Triple Risk Model (Filiano et al. 1994) proposes that SIDS is a highly complex disorder that involves a combination of 1) environmental factors 2) genetic factors (that lead to physiological abnormalities), and 3) timing (occurrence during infancy, a crucial developmental stage). Major environmental factors of SIDS include sleeping position and surroundings (e.g., soft blankets/toys) during sleep (Colvin et al 410). Studies suggest that prone and side-sleeping positions make an infant more susceptible to SIDS due to difficulty breathing. This is notable because asphyxia is a leading cause of death in SIDS which indicates the involvement of the cardiorespiratory centers in the brainstem. As a result, an infant sleeping in the prone position who carries a genetic defect (specifically, one affecting neuronal function) is more susceptible to SIDS. Central Nervous System involvement is further supported by studies that correlate SIDS with abnormalities that include (but are not limited to) those found in serotonergic neurons, astrocytes, and serotonin receptors (5-HT1A and 5-HT1B) in a number of brain regions (Ozawa and Takashima 58). Due to this strong correlation, ongoing investigation of the environmental, physiological, and genetic factors that contribute to SIDS is essential to eradicate the deadly disease.
Molecular motors play key roles in many intracellular biological processes, including signaling and the transport of cargo. Members of the myosin family, one class of molecular motors, perform these functions by moving along actin filaments, double-helical polymers that serve as the highway for motors within the cell. Myosin motors are composed of two polymer chains joined at a pivot with an actin-binding head at the end of each chain. The motor walks forward along the actin, stepping hand-over-hand, by alternating head detachment, with the free end acting as a swinging lever arm. Recent theoretical insights have used polymer mean field theory and first passage time analysis to model the lever-arm mechanics of myosin V, reproducing experimental results for mean step trajectory, run length, and run velocity. We generalize these results to account for steps to all actin-binding sites and derive step distributions that agree with experimental measurements on both wild-type and mutant myosin V motors. A key factor in the walking process is the orientation of the myosin head when it reaches a binding site on the actin. By fitting step distributions to experimental data, we quantify this orientational constraint. Our model may be used to investigate unmeasured structural and chemical properties of myosin V and related motors, including myosin VI, which has an unknown heterogeneous leg structure with both stiff and flexible components.
Characterization of IgG alpha 2,6 sialylation by hybridomas

ST6Gal1 is the only sialyltransferase that adds terminal alpha 2,6-linked sialic acids to the conserved N-linked glycan found within the Fc domain of IgG. It has been shown that these sialic acid residues are required for the anti-inflammatory effects of intravenous immunoglobulin (IVIg) - a widely employed clinical therapy for autoimmune disorders. Until recently, the process of sialylating IgGs had been assumed to exclusively occur intracellularly along the secretory pathway. Our lab has published that mice with a B cell specific knockout of ST6Gal1 had indistinguishable levels of sialylated IgGs in circulation compared to the levels in wildtype mice. These findings indicate that IgG sialylation can occur independently of the B cell secretory pathway, which supports a novel model for an extracellular process of protein glycosylation.

Due to their high levels of antibody production, we are using four murine hybridoma cell lines as models to investigate IgG sialylation by B cells. Here, we show that hybridomas are in fact capable of producing alpha 2,6-sialylated-IgGs in vitro. Since the mechanism by which hybridomas sialylate their IgGs has never been shown, our study aims to clarify the process of IgG sialylation by exploring the intracellular trafficking of IgGs and the potential for extracellular sialyltransferase activity. Understanding the regulation of IgG sialylation in hybridomas has implications for both the fundamental functioning of B cells and the production of drugs in vitro to treat autoimmunity.
Airline "de-hubbing" occurs when a carrier scales back its operations at a hub airport, which may occur following a merger, bankruptcy, or major change in traffic patterns. De-hubbing can have consequences for both the airport and the consumer; airports may lose considerable revenue and jobs, and consumers may have a reduction in flight choice and quality. This paper examined the effect of de-hubbing on three measures – fares, passenger volume and market share. Eleven cases of de-hubbing in the U.S. were considered between 1994 and 2013. Changes in the de-hubbed airline's market share, passenger volume, and airfares were compared in the year prior to and after the de-hubbing event. It was hypothesized that a change in market share would be associated with a change in airfares. Both market share and passenger volume decreased noticeably between the year prior to and one year after the de-hubbing event. On average, market share decreased by 51.2%, and passenger volume similarly declined by an average of 46.2%. Both changes in market share and passenger volume showed a linear trend with historical time: earlier de-hubbing events (those in the 1990s) were associated with greater declines in market share and passenger volume than were later de-hubbing events. The change in airfares following de-hubbing was less consistent, however. Changes in fares ranged from -5.5% to an increase in 46.5% across all eleven cases, with an average increase of 10.1%. There was no relationship between change in airfare and historical time. There also was not a strong or consistent relationship between change in market share and change in fares. With the exception of one outlier, for the majority of cases, smaller changes in market shares were associated with greater changes in fares. This study thus suggests that de-hubbing does not have a uniform effect on airfares, and that changes in airfares likely reflect a broader consideration of market factors besides changes in market share.
American Tank and Fabricating (AT&F), a local Cleveland business, has asked us to improve the operation of their water jet cutting system. We took on a number of projects for them in an attempt to do so. First, we improved the waste disposal system of the system. By separating the solid waste and water waste streams, we predict we will be able to greatly increase the storage capacity of the waste hopper in addition to solving many of the flooding issues AT&F has been having. Second, we will be working to implement a laser alignment system to better align the products for cutting in the water jet system. Currently, a crane is used to shimmy steel plates into place. The computer then alerts the operator if the plate is in position. By automating the system, we hope to improve the efficiency of the alignment. Lastly, we will be creating an operation manual for every process we create as well as a general tip guide for operation. By the end of the project, we hope to combine all three improvements into a system that will result in a positive improvement in the operation of the water jet.
Multilingual code-switching is a multidimensional phenomenon--combining morphosyntactical decisions, emotion, social context and language dominance. Language conflict can result in entire conversations happening in LX, or even just one word. As such, what causes individuals to make this decision? This project reviews prior research, focusing on familial interactions, the factors that instigate code-switching in multilinguals, and how switching relates to the individual’s social role. While the body of literature shows a variety of factors affecting speakers’ minute-to-minute decisions in code switching, the research is inconclusive and points to a lack of intersectionality with neurological findings.
Autism spectrum disorder is a developmental disorder characterized by issues with communication, repetitive motions, and intellectual disabilities with an average age of diagnosis occurring between one and three years of age. In 1998, Andrew Wakefield published research in which twelve children who presented with gastrointestinal issues were admitted to the hospital for study of these symptoms. The paper concluded that all gastrointestinal symptoms, as well as the reported behavioral regression witnessed, could possibly be contributed to by certain environmental factors. This correlation between receiving the measles-mumps-rubella vaccine and onset of behavioral symptoms has since been refuted in multiple research papers. Since then, exaggerated media claims and celebrity support have caused the myth to be perpetuated for far too long. The health implications of this myth are severe. For example, lower vaccination rates can lead to an increase in prevalence of otherwise preventable diseases, such as measles or mumps.

Vaccination is an important topic that affects not only those receiving the vaccines but also those around them. By dispelling the myth that the MMR vaccine has a link to the onset of autism in children, all people will come to benefit from the protection afforded by proper vaccination.
Keithley Instruments is an electrical measurement company based in Solon Ohio and is currently a subsidiary of Fortive which is a recently created industrial corporation. The Released Products Engineering department in Keithley focuses on finding solutions to issues that are found on instruments that have already been released to consumers. This presentation will look at a few examples of such problems and the process behind how they were solved. In order to ensure that company secrets are not unintentionally revealed the circuits that are described will not be given any context in the overall design of each product.
Turing Party is a chat-based online game in which players attempt to discover which members of a chat room are controlled by artificial intelligence (AI) and which members are actual humans. The game is hosted on a website where players may join groups of friends as well as strangers. Once a group has been formed, players will receive randomized names and icons and join a chatroom. AI-controlled players will also join, also using randomized names and icons. All players, both AI and human, will talk with each other for a set amount of time. After this time has elapsed, all human players will vote on who they believe the AI-controlled players are. Any human mistaken for an AI will earn points. Players also earn points by successfully identifying AI-controlled players. By assigning points, we will be giving the players an incentive to perform well and compete with each other. With this game, we hope to create a fun and interesting experience for all users.
Inhibition of the Macrophage Response to Peripheral Nerve Injury

Macrophages are important to peripheral nerve regeneration. However, determining the roles they play in different specific sites is difficult. Using a CCL2 conditional knockout, a macrophage chemokine, macrophages can be specifically inhibited in the sciatic nerve or in the sensory ganglia. This will help elucidate new mechanisms of nerve regeneration.

A defining factor of peripheral nerve regeneration is the accumulation of macrophages at the site of injury and around injured neuronal cell bodies. Macrophages accumulate in these areas due to CCL2 release from Schwann cells and sensory neurons after injury. Determining the importance of macrophages at each site has been difficult; however, previous studies inhibiting macrophages at both sites resulted in a restriction of regeneration. To test each site individually, the cre-lox system was used to knockout CCL2 in the dorsal root ganglia (DRG) or sciatic nerve (SN) by mating CCL2-floxed mice (CCL2 fl/fl) with sensory neuron-expressing cre mice (Advillin-cre) or Schwann cell-expressing cre mice (P0-cre), respectively. First, however, the most appropriate genotype to use as a control must be determined. It is hypothesized that CCL2 fl/fl mice will be better to use as controls for the upcoming experiments. Mice underwent sciatic nerve transection and seven days later, DRG and SN was harvested and sectioned. The tissue was then stained for the macrophage marker CD68. Macrophage accumulation in DRG and SN after injury was measured in wild type, CCL2 fl/fl, P0-cre, and Advillin-cre mice (n=5/group). Using a two-way ANOVA, no significant difference in CD68 staining was found between wild type and CCL2 fl/fl mice in DRG (p=0.754) and SN (p=0.53). The DRG was also stained for activating transcription factor 3, a normal injury/regeneration-associated protein, and no difference was found between CCL2 fl/fl and wild type mice (p=0.632). Thus, CCL2 fl/fl mice will be used as controls.

**Key Words**
- nerve regeneration
- macrophages
- nerve injury

**Abstract**

A defining factor of peripheral nerve regeneration is the accumulation of macrophages at the site of injury and around injured neuronal cell bodies. Macrophages accumulate in these areas due to CCL2 release from Schwann cells and sensory neurons after injury. Determining the importance of macrophages at each site has been difficult; however, previous studies inhibiting macrophages at both sites resulted in a restriction of regeneration. To test each site individually, the cre-lox system was used to knockout CCL2 in the dorsal root ganglia (DRG) or sciatic nerve (SN) by mating CCL2-floxed mice (CCL2 fl/fl) with sensory neuron-expressing cre mice (Advillin-cre) or Schwann cell-expressing cre mice (P0-cre), respectively. First, however, the most appropriate genotype to use as a control must be determined. It is hypothesized that CCL2 fl/fl mice will be better to use as controls for the upcoming experiments. Mice underwent sciatic nerve transection and seven days later, DRG and SN was harvested and sectioned. The tissue was then stained for the macrophage marker CD68. Macrophage accumulation in DRG and SN after injury was measured in wild type, CCL2 fl/fl, P0-cre, and Advillin-cre mice (n=5/group). Using a two-way ANOVA, no significant difference in CD68 staining was found between wild type and CCL2 fl/fl mice in DRG (p=0.754) and SN (p=0.53). The DRG was also stained for activating transcription factor 3, a normal injury/regeneration-associated protein, and no difference was found between CCL2 fl/fl and wild type mice (p=0.632). Thus, CCL2 fl/fl mice will be used as controls.
Investigating the Role of EZH2 in the Cranial Mesenchyme

Proper craniofacial development involves complex genetic and environmental interactions in cranial mesenchyme to allow for differentiation into multiple tissues of the head and face. In order for these tissues to properly form, strict regulation of when and where specific developmental genes are expressed is required. One important form of gene regulation is histone modification by the Polycomb Repressive Complex 2 (PRC2). The developmental importance of PRC2 is highlighted by the fact that a knockout of one of its components, EZH2, results in embryonic lethality during gastrulation. However, PRC2’s tissue-specific roles during development have not been entirely elucidated. We hypothesized that the repressive function of EZH2 is required for the proper formation of the skull bone and dermis during early craniofacial development. Using a CreER system, we conditionally deleted EZH2 in the cranial mesenchyme at multiple time points during craniofacial development. Upon deletion of EZH2 in pre-migratory cranial mesenchyme, there is reduced ossification, thinned dermis and loss of facial structures. Surprisingly, deletion of EZH2 just one day later results in no discernable phenotype indicating a strong temporal sensitivity to EZH2 during craniofacial development. Fully understanding the function of EZH2 at specific developmental windows will provide insight into the temporal specificity of epigenetic regulation during craniofacial development.
With the growing political climate and misconceptions about women in the Middle East, it is important to look at their access to education, both historically and contemporarily, and how this impacts our view of the woman's experience in the region. One must examine the historical evidence and modern trends of education for women in the Levant- Egypt, Syria, Jordan, Lebanon, Iraq, and Turkey- and how education is a significant factor in the development of women's movements both historically and in contemporary times. With the recent revival of the study of the history of women in the Middle East, there is significant documentation to examine these movements; looking at individual countries to paint a larger picture of the region and examine how elements other than religion, i.e. education, are essential to create a multidimensional interpretation. The emergence of the World Wars in the early 20th century led to a restructuring of many education systems in the Middle East, notably with the British imperial presence in Egypt. With today's U.S. presence in the Middle East, education has been detrimentally impacted in others, markedly Iraq. The intersection of education and activism plays a significant part in the understanding of past and current women's rights movements in the countries of the Levant.
The overall purpose of this review is to debunk the psychological myth that the human conscious leaves the body when one is having an out-of-body experience. Consciousness is defined as awareness of one's own existence, thoughts, sensations, etc. Claims of having out-of-body experiences are often rare and mystical tales that are difficult to understand by those who have never had one. It is crucial to understand that those who are more susceptible to claims of out-of-body experiences are often times more imaginative and mentally creative. However, more recent research studies, especially in physiology, are revealing the specific parts of the brain that actually make one believe that they are leaving their body during their experience. Various experiments have recreated the illusion of having an out-of-body experience and measured the participants' brain activity when their brain was detecting where their body was in space. The parts of the brain responsible for spatial orientation and navigation were key in creating the sensation that one’s consciousness was actually physically leaving their body.
Abstract

For patients with neurological disorders of the central and peripheral nervous systems, Traumatic Brain Injuries (TBIs), and spinal cord injuries (SCIs), intracortical microelectrodes hold potential for the treatment of symptoms and the restoration of motor functioning. These Brain Computer Interfaces (BCIs) are commonly used in neuroprosthetic technology to bridge broken neural connections in patients' bodies allowing their thoughts to become the driver of robotic arms, cursors, and other external devices [1,2]. However, the recording quality of these Michigan Style electrodes typically decreases after a year and a half of recordings due to inflammation associated with the implant [3,4]. Discontinuity between the rough architecture of the brain tissue and the smooth face of the electrode causes this inflammation in the host brain tissue. Therefore, the goal of this study is to test if using a focused gallium ion beam to etch topographical patterns onto the surface of Michigan Style silicon probes makes these electrodes more biocompatible with host tissue. Nanopatterned electrodes were implanted into 17 male Sprague Dawley rats for two or four weeks, and postmortem histology and gene expression analysis were used to analyze inflammatory and oxidative stress markers. The histology showed a trend toward decreased neuroinflammation surrounding patterned implants over time by a reduction in active microglia and astrocytes, Blood Brain Barrier (BBB) stability and increased neuronal viability around the implant site. This trend was confirmed with gene expression analysis showing downregulation of CD14, HMGB1, GFAP and IL1? from cells around nanopatterned implants. Future studies involving chronic time points and neural recordings are necessary to evaluate and confirm the trends toward healing here.
## Enhanced Properties for Nanolayered Polymer Films as Capacitor Films

### Abstract
Polymer-based film capacitors are very promising in various applications. In this report, the electrical properties of poly(vinylidene fluoride) (PVDF) and polycarbonate (PC) multilayer films with composition of 50/50 were investigated. 256L films with thinner PVDF and PC layers exhibited lower breakdown strength, higher electric conductivity, and higher ion loss than 32L films with thicker PVDF and PC layers. These differences in electric properties were proposed to result from interfacial polarization due to the permittivity contrast and electronic conductivity difference between PVDF and PC. Interfacial charges provide films with better insulation properties because they provide an opposite electric field and help prevent charge injection from electrodes and leakage through interfaces. 256L films should have less interfacial charges than 32L because thinner PVDF layers provide less space charges (electrons, holes and ions in PVDF) and thinner PC layers conduct more charges through themselves. Less interfacial charges in 256L films was also proved by thermally stimulated depolarization current (TSDC) spectroscopy. As a result, low breakdown strength and higher conductivity were observed in 256L films.
A kinesin-6 family member, MKLP1, limits dendritic branch length in Drosophila sensory neurons

In neuronal dendrites, form regulates function; thus, dendritic arborization is an important determinant of neuronal function. Precise regulation of cytoskeleton organization and dynamics is key to generation stereotyped dendrite arbors during development. Our lab previously discovered that the FoxO transcription factor modulates dendritic branch length in sensory neurons by promoting microtubule dynamics. In motoneurons, we found that FoxO signaling transcriptionally represses the kinesin-6, Pavarotti/MKLP1 (Pav-KLP), which functions to stabilize the microtubule network. The identification of Pav-KLP as a transcriptional target of FoxO in motoneurons raises the question of whether FoxO may also regulate sensory dendrite branch length via Pav-KLP. To test this hypothesis, we investigated the effect of both loss- and gain-of-function of Pav-KLP on dendrite length. We began by assessing Pav-KLP overexpression phenotypes. If FoxO represses Pav-KLP in sensory neurons, we predict that Pav-KLP overexpression phenotypes will mimic FoxO loss-of-function phenotypes. Indeed, we find that the dendritic branch length was reduced in Pav-KLP overexpression. Thus, Pav-KLP may be sufficient to regulate dendrite length. On the other hand, we predicted that Pav-KLP loss-of-function would mimic FoxO overexpression phenotypes. We find that the length significantly increased, suggesting that Pav-KLP may function to regulate branch length. Taken together, our findings reveal a novel role for Pav-KLP in dendrite branching.
### Abstract

The ability to precisely and reliably control the motion of ferromagnetic (FM) vortices in a pinning potential could lead to novel nonvolatile memory devices, and logic gates. By moving arrays of vortices along magnetic nanowires this “racetrack” memory could potentially have faster access times than conventional hard disk drives and be cheaper to produce than random access memories. In this study, we moved a vortex in a bistable configuration of pinning sites on a thin FM disk using magnetic field pulses to jump the vortex between the two pinning sites. To find locations of bistable pinning we scanned the vortex across the disk by sweeping the magnetic field first in one direction, and then in the opposite direction. Locations of bistable pinning were indicated by magnetic field values where the vortex was pinned at positions that differed depending on the sweep direction. Next, from this hysteretic displacement of the vortex core, we constructed a 1D map of the pinning sites around one of the locations of bistable pinning. Field pulses were then applied to switch the vortex from one pinning site to another. The dynamics of the vortex during the switching process were probed using magneto-optical microscopy, and the probability of successfully switching versus pulse length was obtained by using single-spin magnetometry to read-out the final position of the vortex. A model using the Thiele equation of the motion and Gaussian pinning sites was developed to explain important features in the experimental results. The basins of attraction of the two pinning sites were mapped out and used to understand the peaks and troughs in the probability of switching data. Stochastic noise was included in the model to account for thermal effects, and a possible method for fast, reliable switching is also presented.
### Abstract

This poster describes the results of research into the impact of surfactant mixtures used in verification tests run on nonwoven materials for baby and femcare lines at P&G. Nonwoven materials are used for their absorptive and wicking properties—verification of their effectiveness in this regard is important to maintaining high quality standards. Current testing protocols use surfactants in concentrations above their CMC (Critical Micelle Concentration) introducing a potential source of variation in the test results. We were tasked with examining the impact of concentration on the properties of the mixture and to provide recommendations for minimizing variability and optimizing operating conditions.

Two types of trials were conducted, the first of which utilized a static surface tensiometer. These trials were run at varied surfactant concentrations, over varied times and conditions. The experiments give information regarding the homogeneity of the surfactant mixtures over time as well as the dependence of surface tension on concentration. Additionally, tests were run using a low surface tension strikethrough apparatus. These trials provide the numerical basis for a full statistical analysis of the effects of temperature, concentration, settling and mixing conditions on the mixture’s dynamic surface tension and interaction with the nonwoven materials. The results of the analysis will inform P&G about optimal operating conditions for this testing.
Currently, 100 million pounds of rejected tire component are land-filled in the U.S annually. These tires components are comprised of the highest quality virgin rubber and steel but due to the way the body plies are currently made they cannot be recycled and sending them to a land fill is the current solution. In the landfills, the rubber tends to clump together forming pockets of methane gas - these pockets then rise to the surface and are released into the atmosphere. As a result, greenhouse gas is emitted and the equilibrium of the landfill is disrupted. RVS Rubber Solutions has found a way to take this previously unrecyclable component and recycle it. The RVS Tech is quick, efficient, cheap, and best of all - does not degrade the quality of the materials so they can be resold back into the consumer market at a fraction of the cost. RVS Rubber Solutions is a negative waste company attempting to remove, recycle, and re-purpose the rubber components and alleviate greenhouse gas emissions and landfill waste.
### Abstract

This project assessed the feasibility of purifying a hindered phenolic based antioxidant produced by the Lubrizol Corporation. Currently, the Lubrizol Painesville location has a batch reactor process that produces 95 wt% pure product (Compound C) out of reactants Compound A and Compound B (chemical species cannot be named due to the proprietary nature of the project). The goal of the project was to separate the impurities from the final product to create a more pure Compound C (?99 wt%). To achieve this goal, a distillation column was designed in Aspen Plus to simulate a separation of the components. In addition to carrying out a rigorous simulation, the economic viability of the process was also taken into consideration. An iterative and multi-pronged approach was taken to analyse and optimize several separation schemes for their effectiveness of separation and cost. The group achieved 99 wt% purity of Compound C using a packed distillation column 18 ft tall and 1.6 ft in diameter. Supporting equipment includes two plate and frames heat exchangers, a storage tank, and centrifugal pumps. The estimated capital and utility costs are expected to be feasible for the company.
The purpose of this review is to examine the relational myth that opposites attract. We trace the origin of the myth and then take a look at the literature in order to find the data behind attraction in relationships. This myth originated from pop culture and media, as polar opposite couples are more entertaining than couples who are similar. The pervasiveness of the myth is difficult to measure, but an estimated 77% of people believe in this myth. Contrary to popular belief, the literature shows that dissimilarity does not play a role in attraction in relationships. The similarity-attraction hypothesis holds true for relationships, but not in the way one might think. Instead of actual similarity, perceived similarity plays the prominent role in attraction among couples. This shows itself in a number of ways such as projection of self onto others, self-enhancing opportunities, and familiarity. In healthy relationships, individuals project themselves onto their partners which creates a bias for similarity between the two. In addition, in the presence of self-enhancing opportunities, partners perceive similarities that may not actually exist and pursue relationships that affirm their qualities and personality. Lastly, familiarity and trust can facilitate attraction and perceived similarity.
In the development and manufacturing of materials for use in electronics, there is a growing need for scanners that can detect defects in wafers during the manufacturing process. Positrons, as the electron's antiparticle, are well suited for probing the electronic structure of semiconducting materials. Therefore, the goal of this project is to investigate positron based techniques for in-line wafer analysis. The project has investigated positron based spectroscopic techniques, and also how they might be combined with image reconstruction algorithms developed for computerized tomography for use in an in-line scanner.
Abstract

The one child policy of China is seen as a great wall of family planning. It is one of the audacious strategies any country can deploy in the contemporary times to control and manage its population size. However, after more than three decades of the policy being in force, pundits indicate that it has had several implications on the family system and structure.

It is evident that the family structure has been altered by the one-child policy. The intent of this study is to explore the effect of one-child-policy on the family system and structure in China. To effectively comprehend this topic, the research has been subdivided into the following objectives:
I. To explore how one-child policy has led to gender imbalance.
II. To discuss the effect of being the only child in family
III. To assess the implications of one-child policy on taking care of the aging population.
Theory has often associated belief in a just world with religious belief, though with inconsistent empirical support. We investigated whether those with greater belief in a just world have a greater desire to believe in different religious forces that could act as mechanisms of justice, regardless of the level of actual belief. This study tested the preregistered hypothesis that belief in a just world would relate positively to desires to believe in God, the devil, and fate. We surveyed 1668 undergraduates from three US universities about these desires and belief in a just world. As hypothesized, belief in a just world correlated positively with the desire to believe in the three supernatural forces, though these correlations were weak, ranging from .07 to .14. This weak relationship helps to reconcile differences among smaller studies relating belief in a just world and religion, and suggests that belief in a just world may be only one minor factor driving the desire to believe in supernatural mechanisms of justice.
This project, developed by Alex Defiore, Alexis Fatica, & Zach Janice, is called Presents of Mind. It is a website that will aid a person in finding the perfect gift for a loved one by leveraging information on the person’s Facebook profile. The user will input some information about the occasion as well as the target person’s Facebook profile (and/or manually inputted information). A machine learning algorithm will be used to develop possible gift ideas using a training set of Facebook profiles matched to enjoyed gifts. The output of the machine learning algorithm will be run through Amazon’s API to determine other similar gifts that the target may enjoy, which will be returned to the user.
When researching and developing a shaft drive bicycle with a mechanical accumulator for a prior mechanical engineering design class, the need for such a device was realized. Bike riders who live in areas with varying terrain and hills are presented with difficult riding conditions. Some riders are not physically capable of traversing this terrain. Individuals who are elderly, younger, or have some sort of disability but still would like to cycle need some sort of assistance. The design started in the previous mechanical engineering design course used a metal spring with a self-reversing shaft to store energy when a user is pedaling down a hill or on a flat surface. Then, when fully charged, the potential energy can be released, aiding the user in pedaling. The benefits of a mechanical accumulator rather than particular competition such as an electric bike include lower weight, because electric bikes have heavy batteries and motors, and a lower cost because of the simple technology and cheap materials.

During this project comprehensive structural and energy transfer calculations were developed for the mechanical accumulator. The accumulator is capable of providing the rider with a speed increase of 3 m/s when activated. Additionally, an extensive market research and cost analysis was completed to assess market feasibility, and set a market price for the accumulator and bike of $1500. Lastly, CAD models for the mechanical accumulator and shaft drive were improved from the previous design to increase durability while decreasing weight.
We have developed a personalized system that aims to improve the separation of a powder from highly corrosive solvents. By increasing equipment capabilities and developing an enclosed system, the process should be streamlined and potential hazards reduced. GE Lighting, currently faces a problem when separating red phosphor powder from hydrofluoric acid using basic lab equipment. In industrial settings, a process should be ergonomically efficient so that any operator can complete the process to product specifications and without risk to themselves. Highly corrosive and toxic chemicals, like hydrofluoric acid, can present challenges to industry when standardizing a wet-chemical process. In these cases, standard laboratory equipment may not meet the highest standard of efficiency and safety. OSHA’s policy recommends protecting workers from chemical hazards by introducing engineering controls. We used the personalization capabilities of 3D printing technology to design a novel separation system taking inspiration from well-known designs like the syringe and mechanical press. Designing for the process allowed us to combine multiple process steps into the system functionality. Expanding on the basic Buchner funnel, our system safely separates a hydrofluoric acid solution and allows for rinsing with up to two solvent streams while maintaining easy powder collection. Overall, we show that 3D printing can be used to introduce novel engineering controls to lab-scale processes.
### Proposing an Alternative Strategy for Sour Water Treatment: Natural Gas Stripping Method

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Proposing an Alternative Strategy for Sour Water Treatment: Natural Gas Stripping Method

**Elevator Speech**

With the EPA facing potential budget cuts, initiatives that protect environmental health are at risk. Our project embraces the idea that ethical, environmental practices can be green and profitable. By implementing a natural gas stripping sour water treatment process, energy from processed natural gas can be used as a fuel source.

**Key Words**

Sour Water

natural gas stripping

air stripping

**Abstract**

Water is the largest waste stream in oil and gas production worldwide. A common wastewater product from oil and gas facilities is sour water. Sour water must be stripped of its ammonia and sulfur concentrations from an industrial water stream before it can be sent to a wastewater treatment facility. At the facility, the clean water will be either released to the environment or used in other processes as a utility feed, one option could be purifying for steam production. The sour water to be treated has a flow rate of 20-50 GPM with 300-3000 ppm NH3, 5 ppm H2S, and a trace amount of propane. The two methods explored to treat sour water in this research project are natural gas stripping and air stripping. Air stripping is currently the cheapest stripping method used, however, natural gas stripping can be proven to be a profitable and green alternative since it is capable of using energy from processed natural gas as a fuel source. The Annual Capital and Operating Cost (ACOC) for natural gas stripping is $____,____,____.00 compared to air stripping which has a ACOC of $____,____,____.00. The optimum method is natural gas stripping, which is supported by simulations using Aspen and estimations using Aspen's Economic Analyzer.
Graphene oxide (GO), a nanometer thin sheet of carbon atoms containing oxygen-based functionalities such as alcohols and epoxides, is a material of great interest across many fields owing to its diversity of properties. Indeed, GO possesses mechanical strength and electrical conductivity, along with the ability to be functionalized and tailored to specific applications. Although applications of GO’s materials properties have been extensively studied, the use of its biological properties has been investigated to a lesser extent. One potential implementation of GO’s biological properties is in antibacterial applications. It has been found that graphene oxide kills bacterial cells in two ways: 1) the nanometer-thin sheet can puncture cell membranes and 2) an oxidative environment is produced by the oxygen functionalities. As such, researchers have investigated solution-based methods for using graphene oxide to kill bacterial cells with appreciable success. Unfortunately, the use of graphene oxide in antibacterial coatings has not been thoroughly studied. To enhance the effectiveness of graphene oxide based antibacterial coatings, the photothermal properties of the material can be exploited, which allows for a rapid increase of the temperature of the material when irradiated with light. We report the preparation of a graphene oxide-polyethylenimine composite coating and the study of the hybrid material's photothermal properties as a function of weight percent graphene oxide and oxidation state. The optimization of this response to irradiation serves as progress toward developing an effective stimuli-responsive antibacterial coating.
Sink strainers are essential in keeping sinks unclogged and catching debris. This project proposes an adjustable sink strainer that allows the product to fit snugly in any standard size sink and catch debris. This design will be versatile, durable, cost-competitive and applicable in residential and industrial settings.

**Key Words**
sink
strainer
design
materials selection

**Abstract**
Sink strainers are essential in keeping sinks unclogged and catching debris, but finding a strainer that fits a given sink can be a challenge. This project proposes an adjustable sink strainer that allows the product to fit snugly in any standard size sink and catch debris going down the drain. The strainer will have a collapsible, microbe resistant elastomer body with a fine steel mesh at the bottom. The lip of the strainer will taper so as to form a seal with the bottom of the sink. This will allow for the strainer to contour the sink and prevent loose items from falling into the pipes while maintaining proper drainage. The materials selected provide flexibility, strength, and corrosion resistance at a competitive price, while the structure allows it to filter debris from a wide array of sink designs while maintaining proper drainage. Additionally, the strainer will be easy to remove from the sink for cleaning. Overall, this sink strainer can be used in residential and industrial settings to help prevent buildup of debris and clogged pipes.
### Abstract

Molybdenum Ditelluride can exist in two different solid crystal arrangements at room temperature. We investigate the ability to change the crystal phase of two dimensional molybdenum ditelluride from the 2H semiconducting crystal phase to the 1T' semimetal phase under tabletop conditions. The successful ability to complete this transition and to reverse it, makes it an ideal candidate for a phase change memory device.
Monocarboxylate transporters, constitute a family (SLC16) of proton-linked plasma membrane transporters that carry molecules containing a single carboxylate group across biological membranes. Basigin (CD147), is involved in many physiological functions during early stages of development and in cancer. Basigin has been shown to be required for functional plasma membrane expression of Monocarboxylate transporter-1 and Monocarboxylate transporter-4. Using a cell-based screening assay, we identified a small molecule that inhibits the binding between Basigin and Monocarboxylate transporters in vitro and in vivo. Surface Plasmon Resonance analysis confirmed direct binding of a small molecule, acriflavine, to Basigin’s immunoglobulin extracellular domain with a low binding constant (kD) of 0.16uM. Acriflavine inhibits normoxic growth of glioma stem cells in vitro and this activity is augmented by hypoxia or by expression of oxygen-stable mutant forms of HIF-1α or HIF-2α. Treatment of mice bearing established glioma stem cell-derived xenografts resulted in inhibition of tumor growth. Acriflavine treatment inhibited intratumoral expression of the angiogenic cytokine vascular endothelial growth factor and tumor vascularization. Our work shows that disruption of monocarboxylate transporter binding to Basigin is an effective approach to target glioma stem cells.
Recombinant adeno-associated virus (rAAV) vectors have been successfully used to deliver genes encoding therapeutic proteins to treat a variety of diseases with limited immunogenicity and few side effects in animal models. Several rAAV-based gene therapies have also recently received approval to treat diseases in humans. TNF-Related Apoptosis-Inducing Ligand (TRAIL), a highly selective tumoricidal protein with very low nonspecific cytotoxicity, has shown great promise in treating several types of cancer in mouse models. However, the natural TRAIL protein has a fairly short half-life, severely limiting the clinical potential of directly injecting recombinant TRAIL. rAAV-mediated intra-tumor expression of TRAIL partially bypasses the half-life issue and has achieved good results for some cancers in animal models. This study aims to develop a highly effective anti-cancer gene therapy by evaluating in vivo rAAV-mediated expression of TRAIL variants with enhanced activity and half-life. These include LZ-TRAIL, which contains an attached leucine zipper motif that was reported to promote formation of TRAIL trimers (the active TRAIL form) and extend half-life. Mice were transduced intramuscularly with rAAV vectors expressing either unmodified TRAIL or LZ-TRAIL. Serum TRAIL concentration was assessed by ELISA over a period of up to 24 weeks post-transduction. Relative to unmodified TRAIL, LZ-TRAIL expression took longer to become detectable, peaked at significantly lower concentrations, and failed to occur in all transduced mice. These results suggest that the leucine zipper motif may actually limit the in vivo expression level of TRAIL. Assessment of other TRAIL variants with extended half-life is ongoing.
As an increasing number of women have started becoming physicians, a field that has been dominated by men for years, there are many issues in which they are forced to face as they overcome gender roles and expectations. In general, physicians have a high rate of burnout, or emotional exhaustion due to lack of job satisfaction, than other professions. This is especially true among female doctors. Through reviewing literature it becomes apparent that women are not treated equally to men in the medical field, which leads to increased burnout among female physicians. Women are harassed into less prestigious specialties than men and receive lower pay within the same specialties than men do. Along with this, female physicians have higher expectations than their male counterparts to balance work-family life. Additionally, patients tend to prefer male physicians over female in the majority of specialties despite female physicians proving to have more desirable qualities in their methods of practice. These are problems that are specific to women in medicine that are not relevant for men and can lead to large amounts of stress and exhaustion. Trends suggest that more women will continue to become doctors, causing a feminization of medicine to occur. This will likely lead to a decrease in the inequalities faced by female physicians and therefore decreased burnout rates.
Using ultra-high-energy cosmic ray detectors to search for macroscopic dark matter

Abstract

Dark matter may consist of macroscopic objects atomic or greater density, known as macros. Of particular interest are objects of nuclear density, that may have been formed before big bang nucleosynthesis, such as during the QCD/chiral phase transition. As macros would travel at speeds characteristic of velocities in the Milky Way (≈ 250 km/s), their atmospheric penetration should cause nitrogen luminescence, in a similar manner to ultra-high-energy cosmic rays. In this work, we produce an accurate model of the light spectrum emitted by these hypothetical macro events. The Pierre Auger observatory, which is sensitive to nitrogen luminescence, is attractive to use in the search for dark matter, as its 3000 km² makes detection of many low probability macro events feasible. However, as Auger is designed to detect ultra-high-energy cosmic rays, which travel near c, any potential macro events will have been thrown out as noise. We use the results of our analysis to suggest changes to the Pierre Auger fluorescence detector's hardware triggers, so that macro events can be recorded, if they exist.
Colon cancer is the second leading cause of cancer death in the United States. More than 50,000 deaths per year can be attributed to colon cancer. The incidence of colon cancer is higher in individuals who are over 50, and tends to increase with age. Recent studies have shown that although the risk of colon cancer is typically lower in those individuals under the age of 50, there is a significant increase in the frequency of colon cancer in younger individuals as well. Treatment depends on the size, location, and how far the cancer has spread. Common treatments include surgery, chemotherapy, and radiation therapy.

15-PGDH has been discovered to be a colon cancer suppressor gene that controls the degradation of bioactive prostaglandins. 15-PGDH is highly expressed in normal colon cells, but its expression is lost in 90% of all colon cancers. Those with low colonic PGDH levels are more resistant to the protective effects of non-steroidal anti-inflammatory drugs (NSAIDs) that aid in preventing colon cancer. Also, patients with low PGDH levels are more at risk to colon cancer. Furthermore, recent studies suggest 15-PGDH plays an important role in the regeneration of damaged tissues of the colon, liver, and the hematopoietic system.

Having a mouse model that reflects the dynamic range of colonic 15-PGDH expression detected in humans would enable us to better understand how 15-PGDH levels impact colon cancer risk, response to NSAID chemoprevention, and regulation of tissue regeneration. We have begun to determine colon 15-PGDH mRNA expression levels in various mouse strains by quantitative real-time PCR to find 15-PGDH high and 15-PGDH low expressers. To date we have screened female and male mice from three mouse strains. Thus far, we have observed a 1-3 fold difference in the 15-PGDH levels of mice in different strains, but no fold difference between the female and male mice within the same strain.
Human Enterovirus 71 (EV71) is an emerging pathogen of infectious disease, for which no known antivirals or vaccines currently exist. The current absence of knowledge on how this agent interacts with the host cell to facilitate translation and replication emphasizes how important research into host-pathogen interactions are. Previously, it has been shown that a cytoplasmic factor, hnRNP D0, can down-regulate EV71 viral translation and replication. Specifically, hnRNP D0 can bind to the Internal Ribosome Entry Site (IRES) of EV71 to inhibit translation. Crucially, this interaction between EV71 and hnRNP D0 is highly specific, such that any mutation in the binding region of hnRNP D0 eliminates this inhibition. The region of hnRNP D0 which binds to EV71 is divided into 2 segments, RNA Recognition Motif 1 (RRM1) and RRM2. Although NMR studies of both RRM1 and RRM2 together have allowed determination of the structure of EV71-hnRNP binding structure, it is unknown whether RRM1 & 2 form similar binding structures when separated from one another. Insights into the binding structure and behavior of RRM1 with the IRES should allow for a deeper understanding of how hnRNP D0 as whole binds to the EV71 IRES, allowing for the potential development of antivirals and vaccines which exploit the RRM1-IRES binding structure to impair EV71 translation and replication.
Functional Evaluation of Umbilical Cord Tissue Derived Mesenchymal Stem Cells

Introduction: Inflammation and infection are a component of a variety of pulmonary diseases. The umbilical cord is discarded post-delivery. Mesenchymal Stem Cells derived from Umbilical Cord Tissue were investigated to determine their anti-inflammatory and anti-microbial activities. Donor variability was determined.

Methods: Cord Blood Registry® provided hMSCs which were cultured with or without lipopolysaccharide (LPS) or peptidoglycan (PEP) and granulocyte macrophage colony-stimulating factor (hGM-CSF) for 24 hours. hMSC supernatants were analyzed for secreted cytokines by Luminex (mean±SEM pg/ml) and for gene expression by RT-PCR (mean±SEM, change in cycle threshold, Delta CT). hMSCs antimicrobial functional activity was measured using Pseudomonas aeruginosa (PA) growth and anti-inflammatory activity on inflammation induced epithelial cells. Statistical analysis was done with Graph Pad Prism6.

Results: hMSCs secreted MIP-3 alpha, IL-8, IL-6, IL-1Beta, and TNF-alpha (n=4, p<0.05). LPS increased MIP-3 alpha (4.18±1.0 pg/ml), IL-6 (6315±4029 pg/ml) and TNF-alpha (7.84±2.4 pg/ml). PEP increased MIP-3 alpha (4.18±1.0 pg/ml), IL-8 (7753±1613 pg/ml), and IL-6 (6247±3915 pg/ml). GM-CSF increased MIP-3 alpha (4.69±0.5 pg/ml), IL-8 (7317±781 pg/ml), IL-6 (6378±3924 pg/ml), and TNF-alpha (7.59±1.4 pg/ml). hMSCs expressed IL-6, IL-8, and CCL-20. LPS increased the gene expression of IL-6 and IL-8 and decreased CCL-20. GM-CSF increased IL-6, IL-8, and CCL-20 gene expression while PEP decreased IL-6 and CCL-20. PEP and GM-CSF decreased the gene expression of SCF and MCP-1 while LPS increased SCF and decreased MCP-1. Functionally, hMSC supernatants decreased PA CFUs from 250 to 27. Cord tissue derived hMSCs supernatants had anti-inflammatory activity, which was enhanced by LPS (-3.95 vs -4.98 cycle difference).

Conclusions: hMSCs secrete a variety of cytokines and display anti-microbial and anti-inflammatory activity. Donor variability was demonstrated.
This project shows that fire can be extinguished with sound frequencies, possibly providing a better method of extinguishing fire. The most effective frequency for extinguishing fire was found through recording the amount of time it took different frequencies on intervals of five hertz from 30Hz to 50Hz to extinguish fire. The most effective frequency was 45Hz. The project then tested how harmonic ratios would affect the 45Hz. On average, 45Hz and its first harmonic ratio extinguished fire in 6 to 20 seconds. Without the harmonic, 45Hz took 20 to 40 seconds to extinguish the fire. Using 45Hz and its first harmonic was more effective than using 45Hz alone.
Breast cancer is the most prevalent cancer in women worldwide. As of March 2017, over 3 million women will have survived or been diagnosed with breast cancer in the United States alone. It is projected that in 2017, 30% of all new cancer cases for women in the United States will be breast cancer. Although several treatment options exist for women diagnosed with breast cancer, there has been a rise in women opting for complete amputation of one or both breasts known as mastectomy, a more aggressive type of treatment compared to breast conservation surgeries. This trend persists for women diagnosed with early stages of breast cancer. Retrospective studies show the gradual increase of women electing to undergo unilateral mastectomy of the cancerous breast from 11% in 1998 to more than 36% in 2011. Several factors may influence why breast cancer patients choose mastectomy, including the type of breast cancer, fear, a sense of control, and physician influence. Still, studies have not come to a concrete conclusion as to why women undergo mastectomy. The purpose of this study is to consider why women choose mastectomy as a treatment plan and to examine the mental, emotional and physical challenges women face once they have undergone mastectomy surgery. Several interviews were conducted for additional insight into the physician's perspective of mastectomy and reconstruction procedures as well as personal patient experience. Further research was done to investigate the benefits, drawbacks and risks involved with mastectomy and differing reconstructive surgeries.
The effect of weather patterns on wintering waterfowl behavior in a small lake biome

As climate change becomes more important, wintering animals will face increased challenges. This project examines responses of local birds to rapid changes in temperature.

Canada geese and Mallard ducks provide a unique opportunity for investigating how seasonal weather patterns affect individual and flock behavior of waterfowl. These birds commonly inhabit northern climates year round. During wintering months, decreasing temperatures pose a challenge to warm blooded organisms, which require ample food to support high metabolisms. Waterfowl are especially susceptible in winter due to their unique niche on the surface of ponds and lakes that have the potential to freeze. We hypothesize that wintering waterfowl use fluctuations of environmental conditions, such as changes in pressure, temperature, or humidity, as cues for eliciting behavioral changes. This winter season has provided a unique opportunity to collect data, since the temperature was extremely variable from week to week. Shaker Lakes in Cleveland Heights, Ohio repeatedly froze over and thawed, making it an ideal target for our study. Behavioral and census data were recorded daily in conjunction with weather statistics with a special emphasis placed on transitional periods (i.e. between hard freeze and open water). As temperatures decreased, active swimming and foraging behaviors were consistently replaced by huddling in sheltered areas. When the lakes were completely frozen over, the birds quickly left, presumably for open waters surrounding Shaker Lakes. For example, we noted that when Shaker Lakes completely froze over, there was a complete loss birds there coupled with the appearance the same types of birds on the unfrozen Wade Lagoon. In order to further confirm this prediction, we hope to employ the use of weather radar in tandem with bird detection software. We also plan to analyze behavioral and flock size data in order to further understand if these migratory behaviors result from detection of minor changes in atmospheric metrics.
Abstract

The poster reviews the Mozart effect and the evidence in support or against the phenomenon. The Mozart effect states that listening to classical music, namely Sonata for Two Pianos in D major, K. 448, temporarily enhances intelligence in terms of spatial-reasoning. Spatial reasoning refers to the ability of perceiving and manipulating objects in three dimensions. The justification was that classical music primed neural firing patterns, which therefore enhanced the cortex and higher brain functions. After the initial experiment in 1993, replication studies have shown varying responses of varying degrees, and even to this day there are no definitive results. However, many experts in the field of psychology agree that the temporary enhancement in spatial-reasoning from Mozart’s music is due to an artifact of arousal of mood rather than the hypothesized neural resonance.
The purpose of this study is to evaluate feasible options for a logistical pumping system across a company’s expansive infrastructure in collaboration with Nexus Engineering Group. Current procedures for packing products in the facility use a manual system which poses human safety risks and results in heavy freight truck traffic. To improve safety, efficiency, and allow for expansion, a common pipeline system and central packing facility will allow for logistical improvements. A pigging system was adopted, which will clean pipes between products and allow for common pipelines with multiple compatible products. Constrained by the packing temperature, compatibility, and resulting viscosities of all 400 products, possible pipe schemes based on various pipe diameters and the total number of pipes were created. A recycle stream was added to avoid dangerous pumping pressure in positive displacement pumps and maximize the product flow rates. To optimize capital investment, the heating element costs and number of pipes were minimized while providing sufficient flow rates to avoid production bottlenecks. This design is optimized for efficient packing, capital investment, and future expansion. The final scheme will be presented as a Select Stage or Stage 2 of the project development activity for the customer. If the company accepts this design, it will be further developed for implementation.
### Abstract

The development of an effective and mechanically robust organogel coating that is both superoleophilic and under-oil superhydrophobic is presented. The organogel was shown to absorb and retain oil, and as a consequence render the surface superhydrophobic. The coating showed high repellence against water while letting oil pass through without the need to apply pressure. Utilization of the coating in oil and water separation was investigated and the separation efficiency was found to exceed 99% for a wide variety of commercial oil. The coating was also shown to be mechanically robust and can withstand shear tests of different strengths and duration.
**Abstract**

A recurring question in the field of orthopedics revolves around rehabilitation. How can physicians treat their patients in ways that will allow them to get back to their daily lives sooner and without restrictions, specifically following bucket-handle tears of the meniscus in the knee joint? With today's current surgical techniques, it can take up to eight weeks of rehabilitation, five of which the patient is immobilized, before the patient’s knee joint becomes fully weight bearing again (Brindle, 2001) posing problems for those in the work force, or athletes trying to get back to playing. By considering new suture patterns with an increased number of ligatures, using an all-inside FasT-Fix repair tool, we will evaluate the level of gapping of a repaired tear to see if it is possible to become fully weight bearing earlier in the rehabilitation process. After analyzing the results from multiple model testings, any needed adjustments will be made for testing of bovine menisci. Building upon results from this first phase of the project, phase two will examine the effect of such suture patterns on the gapping of bucket-handle tears in a full bovine knee joint. Phase three will then investigate how a human cadaver full knee joint reacts under these conditions, and if these suture patterns are able to provide a way to allow patients who suffer a bucket-handle tear of the medial meniscus a faster time frame to become full weight bearing. Due to the lack of the literature found on full knee joint studies, results from this study should open doors into new research to better the patient care process.
Bateman’s principle suggests that, because male gametes are energetically cheap to produce and eggs and parental care are costly, female reproductive variance should not be dependent on access to mates, but rather by access to resources. This suggests that females might experience strong selection pressure to produce only as many gametes as they have the resources to mature. However, a surprisingly large amount of flowering plants make far fewer seeds than ovules, such that they make fewer seeds under ambient conditions than when pollen is supplemented experimentally, a phenomenon called pollen limitation (PL). Environmental stochasticity, which often results in large variation in the reproductive success of both males and females, could be one explanation for such unexpectedly high rates of PL. I hypothesized that, in a stochastic pollination environment, non-autogamous Trillium grandiflorum plants overproduce ovules relative to average pollen receipt as a “jackpot” strategy that is advantageous in the case of randomly high pollen loads. The results of a pollen supplementation experiment on natural T. grandiflorum populations at the CWRU Farm revealed that plants supplemented with pollen set 11% more seeds on average than plants left open to the ambient pollination environment (95% CI [0.178, 0.847], mean PL effect size=0.45), indicating that T. grandiflorum was pollen-limited and overproduced ovules relative to average pollen receipt. As anthropogenic changes continue to drive declines in pollinator service, studies evaluating the evolutionary causes and consequences of PL will be valuable to our understanding of how plants might perish or persist in changing environments.
This project encompasses the analysis, design, manufacturing, and testing of a small-scale hybrid rocket engine. The engine uses hydroxyl-terminated polybutadiene as the solid fuel and gaseous oxygen as the oxidizer. Analysis of the engine was conducted using MATLAB in order to model and estimate engine performance parameters such as specific impulse and thrust. Modeling utilized empirical regression rate data for hydroxyl-terminated polybutadiene/gaseous oxygen to estimate oxidizer to fuel ratio varying parameters and ultimately the mass flow rate through the engine. Determination of these parameters guided optimization of engine sizing and geometry in the final design.

Motivation for this project came out of a desire to gain practical industry experience in the design of propulsion and fluid systems and as a way to supplement the senior Propulsion and Aerodesign design classes. In addition, after graduation I will begin working at Blue Origin as a Propulsion Development Engineer and this project, in conjunction with the previously mentioned classes, will be very valuable in becoming more comfortable with designing and building propulsion systems. Prior to senior year, I worked at the SpaceX Rocket Development & Test Facility designing fluid systems as well as testing flight components for the Falcon 9 launch vehicle. Based on this experience, this project has posed challenging, but within reach.

In addition to modeling the engine, the fluid mechanics of the stand were also modeled using compressible flow techniques to estimate flow rates and size fluid components. The test stand fluid system is comprised of an oxygen system to supply gaseous oxygen to the engine and a nitrogen purge system to safe the engine post-test.

Testing of the engine will be conducted at the Sierra Lobo test facility in Milan, Ohio. Testing will measure engine thrust and oxidizer mass flow rate using a data acquisition system and allowing the calculation of specific impulse.
The advancement of organic photovoltaic devices (OPVs) depends heavily on the development of materials with high charge carrier transport. The time of flight (TOF) method measures the extrinsic carrier mobility and provides information on carrier transport and trapping mechanisms. This project will focus on TOF studies of novel organic materials that are easily produced and environmentally green. The carrier mobility and its electric field dependence will be studied using TOF. The electric field dependence along with the details of the TOF current transient reveal carrier trapping and the transport mechanisms. This research mainly focuses studying the transport of holes and electrons in bulk heterojunction materials of poly(3-hexylthiophene-2,5-diyl) hole transport material and two electron transport materials. The mobility and charge transport processes will be discussed.
It is widely known that the formation of simple prebiotic organic compounds on early earth are important to the origin of life. Aqueous high-pressure chemistry under the conditions within cometary ice during planetary impact is a likely mechanism for the formation of initial amino acids. The proposed research will start out with small organic molecular acids and bases and will employ simple, reproducible reaction conditions (heat and pressure) to mimic the aqueous high-pressure chemistry during the impact of comets or the interior of the early earth. Our research has shown that it is possible for carbon dots to form at very minimal heat temperatures (160 K). Spectroscopic studies such as 1H and 13C NMR, UV-visible and fluorescence spectroscopy, and Dynamic light scattering (DLS) have given more insight on the structure and properties of the carbon dots.
Abstract

German scientist Wladimir Koppen presented the first quantitative classification of world climates in 1900. This system was based on Koppen’s knowledge that plants can serve as an indicator for several climatic elements. Koppen’s system was then updated in 1954 and 1961, and provided as a world map by Rudolf Geiger. Since its’ inception, this classification system has been widely used from all disciplines, but the maps provided by Geiger are difficult to locate. Consequently, in 2006 a digital map was created by Markus Kottek, Jürgen Grieser, Christoph Beck, Bruno Rudolf and Franz Rubel.

Now that Kottek and his colleagues have made this information more easily accessible, there is now a need for additional resources that use this data. As of January this year, applications are being made to convert this digital map into KMZ files that can be utilized by Google Earth. However, there is still a lack of packages available for R users that will allow them to receive climate zone classifications for locations of interest. Through the research being conducted, I will be able to begin to fill this gap by providing a useful, open source tool for R users.
Characterizing the Transcriptional Activity of POU and Esrrb in Schistosoma mansoni

Abstract

Esrrb (estrogen-related receptor beta genes) and POU (Pituitary-specific Octamer transcription factor proteins Unc-86 transcription factor) class genes have been shown to induce pluripotency within already differentiated cells. In order for this capability to be possible, these classes of genes function as regulatable transcriptional activators through differentiation. Esrrb aids in the activation of Oct4 to sustain cell renewal. Parasitic schistosomes are responsible for the chronic disease schistosomiasis and infect over 200 million people. There is currently no schistosome cell line, and schistosomes do not express all of the Yamanaki factors including Pou5, but they do express Esrrb and other POU proteins. This ability may potentially allow the creation of a schistosome cell, Establishing a cell line will make it possible to perform experiments such as knock-in and knock-out experiments due to the lack of a germ line. This research may potentially lead t

Key Words

Schistosomes

Genetics

Transcription Factors

Elevator Speech

Schistosoma mansoni is a tropical freshwater parasite that causes schistosomiasis, a disease that affects over 200 million people globally and can cause symptoms ranging from benign ones like itchy skin and coughing to more serious ones like seizures, paralysis, and may cause death. There is currently no way of characterizing much of the genome as there is no way of performing experiments like knock in and knock out experiments due to the lack of a germ line. This research may potentially lead t
**Title**: The Equilibrium Shape of a Dielectric Droplet in an Electric Field

**Elevator Speech**: Once the equilibrium shape of a droplet in a vacuum is found, physicists can more easily study more complex scenarios, and therefore can learn how to manipulate certain fluids.

**Abstract**: The goal of this senior project is to calculate the shape of an insulating droplet treated with an electric field, and with a surface tension, a problem that currently has no answer. The shape of a droplet, insulating or conducting, is determined by two forces within: a surface tension force that favors a sphere, and an electrostatic force that prefers a longer, more needle-like shape. To solve for the equilibrium shape of the droplet requires finding the shape associated with the minimum sum of all energies, which requires finding the potential of the droplet from the electric field. Ideally, this project will result in finding a single, multi-term equation that can summarize important aspects of the droplet’s ideal shape.
Modeling a carbon capture process using Volt's proprietary technology in Aspen Plus, and analyzing cost using Aspen Economic Analyzer. Typical carbon capture processes require a large investment for little energy gain. Using Volt's Proprietary technology the cost can be reduced, while keeping the energy production the same. Key features include heat exchanger networks, amine separation unit, and a reformer. The Amine separation unit in particular utilizes MEA to strip carbon dioxide from the exhaust gas to then be pumped back into the ground.
When alcohol is consumed during early pregnancy, abnormalities in the embryo and the fetus may result from abnormalities of neural crest cell biology. The consequences, Fetal Alcohol Syndrome (FAS), persist as a major problem worldwide. The hypothesis tested is if alcohol damages neural crest cells, then their derivatives, the autonomic nervous system and smooth muscle cells around some coronary vessels, would develop abnormally. This may lead to arrhythmias and coronary anomalies that could impact morbidity and mortality. Quail eggs were injected with alcohol to mimic a session of binge drinking early in pregnancy. The control eggs were injected with saline. Both sets were incubated until embryos would normally form four chambered hearts with coronaries and autonomic innervation. The ethanol-exposed embryos had a 58.3% survival rate, while 83.3% of the control embryos survived. This data matches the survival rates of our previous experiments. To visualize cardiac innervation, hearts from surviving embryos were permeabilized with detergent, and an immunostaining technique was used to fluorescently label neuron-specific tubulin (TUJ1). TUJ1-stained nerves of ethanol-exposed embryos covered a smaller area of the heart surface and branched with more acute angles compared to hearts of control embryos. A novel technique, SLIME (Scatter labeled imaging of microvasculature in excised tissue) was used to detect coronaries. SLIME, a titanium-containing colloid solution, was injected into the aorta while vessels were visualized with optical coherence tomography during the filling of the coronaries. The sequence of vessel filling was atypical in ethanol-exposed quail embryos, indicating abnormal connections of the coronary vasculature. The results suggest that early ethanol exposure mimicking early binge drinking during pregnancy leads to abnormal autonomic innervation and coronaries.
Chilled water systems are commonly used in large buildings to maintain constant internal temperatures. When paired with ice storage systems, chillers are capable of running at higher efficiencies and require less maintenance. Ice storage systems utilize energy during off-peak hours to store thermal energy through ice formation. Cooling is provided by melting the ice during peak hours to supplement the chillers and increase overall system efficiency. This study examines the feasibility of integrating ice storage with the existing chilled water system serving Case Western Reserve University’s science quad. Currently, the chillers operate at a minimum of 0.674 kW/ton, not including the effects of other system components (pumps, pipes, etc.), while it operates around 0.992 kW/ton including these components. This leaves room for significant improvement in the system’s operation. Capital costs for the project can be offset by a decrease in energy demand charges during peak hours and an increase in chiller efficiency. The integration of ice storage has the potential to increase campus sustainability and decrease energy costs of the university.
**Title**

Low-Field Transport Properties of 2D Electron Crystals in a GaAs-AlGaAs Heterostructure, subjected to Mesoscopic Constraints

**Elevator Speech**

A difference in transport properties with and without mesoscopic constraints could imply the existence of a "mixed" state of liquid and crystallized electrons, which would be a more classical, macroscopic behavior.

**Abstract**

A mesoscopic pattern is imposed onto a gallium arsenide-aluminum gallium arsenide (GaAs-AlGaAs) heterostructure through photolithography and wet etching. The transport properties of electron crystals that form in the mesoscopically-constrained, two-dimensional quantum well will then be measured in the absence of an applied field in order to determine the possibility of a mixed state of electron crystal and liquid.
The planet Venus is currently in a massive greenhouse state, with surface pressures nearly 90 times greater than Earth's and temperatures approaching 500°C. Chemical reactions between Venus' crust and atmosphere have been hypothesized to either maintain the greenhouse environment or modify it over the planet's history. Unfortunately, existing models are inconsistent with respect to the specific reactions that may be taking place and their relative importance. This makes it difficult to comprehensively model the origin and ultimate fate of Venus' greenhouse state.

Our group is conducting a broad experimental study that exposes key basaltic phases to Venus-like atmospheric chemistry and/or physical conditions on the premise that the exposure of new volcanic rock at the planet's surface would be a key driver of chemical reactions. Pyroxene- and feldspar-group minerals are key phases in our study as are olivine and glasses of basaltic and calc-alkaline compositions. Our goal is to identify key reactions that take place in these experiments and the secondary minerals they produce. This research is part of an ongoing project at NASA Glenn Research Center utilizing many sophisticated apparati including the Glenn Extreme Environment Rig (GEER). The apparatus serves as a high-fidelity simulation of the Venus atmosphere that includes accurate temperature, pressure, and gas composition to the parts per billion level.
Abstract

This project aims to create a dynamic temperature model of a river dam reservoir by modeling its heat flow. Using surface temperature and velocity data for a river dam reservoir, the model finds the subsurface temperatures.

The initial model created for this project is a compartment model. It is based on data collected during the summer, so it is designed to model heat flow when the temperature of the water on the surface of the reservoir is warmer than the temperature of the water entering through the river. Near the river, water flows from surface compartments to subsurface compartments leading to dominant subsurface flow. Factors like heating of the water due to temperature differences between the surface and the air temperature and gradual heating of the subsurface due to diffusion are also accounted for in this model.

Versions of this model for large and small reservoirs were created. The small reservoir model was used for modeling data collected at a reservoir in Mill Creek Park, Youngstown Ohio. The large reservoir model was used to model data collected at the Gorge Metropark Cuyahoga River reservoir. The model works well for the data collected, but has a number of limitations based on its simplifying assumptions. For example, the model does not explain how temperature changes throughout the compartments.

The improved model uses a finite element method approach to solve for the temperature over the subsurface using surface temperature and velocity data. A mesh generator is used to create a mesh in the shape of the reservoir and the temperature is then calculated at each node. The resulting model gives a more accurate description of the subsurface temperatures of the river dam reservoir.
The study of the cohesive/adhesive properties of asteroidal surface material is of significance to future space missions, near earth asteroid hazard mitigation, and understanding the history of small planetary bodies. Understanding these materials for specific smaller bodies such as C-class asteroids is particularly important because they are so small that gravitational forces become minor compared to electrostatic, triboelectric, solar radiation pressure, and van der Waals' forces. Measuring these properties is usually accomplished utilizing terrestrial analog materials given the limited availability of extraterrestrial samples. We used both CM2 meteoritic material and terrestrial serpentine as proxies for asteroidal regolith in experiments measuring adhesive/cohesive forces conducted at NASA Glenn Research Center. CM2 chondrites are a reasonable simulant considering they are most-likely derived from C-class asteroids. CM2 meteorites consist primarily of matrix (over 90% by volume) composed of serpentine group phyllosilicates. However, this matrix is dramatically different in terms of elemental abundances from terrestrial serpentine. Our work compares the behavior of terrestrial serpentine to CM2 matrix material during measurements of cohesive/adhesive forces and explores whether terrestrial serpentine is similar enough mechanically and compositionally to use it as an analog for C-class asteroid regolith.
Yost Hall was formerly a dormitory used by Case Institute of Technology (CIT). The building was re-purposed by Case Western Reserve University (CWRU) for classrooms and offices for the mathematics department and university administration. However, the space remains as it was originally designed, which is not conducive to an academic or administrative environment. Given this, the Avengineers Corporation proposes to demolish the existing building and construct a new Yost Hall.

The proposed design is a five story building that is nearly twice the footprint of the existing Yost Hall. Three stories of the structure will be above ground while the bottom two stories will be located within the slope on which the existing building rests. The top three stories will protrude past the footprint of the bottom two stories and overhang over a proposed expansion of the parking lot. Structural columns spaced in the parking lot will support the overhanging portion of the structure.

The proposed parking lot will maintain university permit parking as well as university service vehicle parking spaces. It will use recycled portland cement concrete from the demolished building for the subgrade fill layer of the pavement system. Also, the traffic intersection for entering and exiting the parking lot will be updated to consider traffic entering and exiting the parking lot through the addition of two loop detectors in the two proposed exit lanes for the parking lot.

Stormwater landing on the project site will drain to a proposed bioswale water detention device on the Martin Luther King Jr. (MLK) Drive side of the project site. After water filters through the bioswale, an inlet in the device will direct the water to the Doan Brook culvert, located underneath MLK Drive.

Given the design and construction materials, scope, and schedule for this project, the conceptual estimated cost for Yost Hall is approximately between $30 and $40 million.
Wireless technology has advanced to the point that it rivals wired stability and speed, which has resulted in an increased interest in wireless devices. This project involves the modification and configuration of an existing serial sensor connection to a WiFi-based data connection that will securely and successfully transmit data for an air quality monitoring system. The goal is to develop a robust, simple-to-use system that can quickly be configured by an end-user with little technical knowledge. We will use a Silicon Labs WGM110 Wizard Gecko WiFi module alongside an encoding and packaging program of our own design to take serial air quality data and wirelessly transmit it to a gateway that will interpret and upload the data. Specific effort has been made to secure the device and the data from attackers using WPA2/PSK encryption and the TLS security/authentication protocol.
Band Songbook is an Android and iOS application that is intended to help rock bands and similar ensembles practice together, in real time. This app will take advantage of a music notation system called “tablature” that allows untrained popular music musicians (specifically, guitarists and other stringed instrument-players) to try out new songs with ease. Additionally, it supports an arbitrary number of users reading the music at the same time, allowing anyone in a band with a smartphone or tablet to easily play the same song. This system is intended to be easy to use as well as cross platform.
Current metal additive manufacturing technology produces parts with high degrees of porosity which severely limits the attachment that can be achieved in a weld joint. Meanwhile, friction welding uses friction to generate heat and force diffusion between two parts to create a welded joint. Both of these technologies are recently developed with many intricacies still emerging. This project proposes to develop a nickel-titanium alloy capable of being both 3D printed and welded using friction welding. The design of the alloy aims to optimize low thermal conductivity, high specific heat, and low melting temperature.

Based alloy selection has been done using CES EduPack to compare materials and material properties to optimize the currently used alloys. Additional work has been done researching the processes, applications, and materials. Thermoclcac Software allows for the material phases to be identified which can allow for further research to understand the properties of the resultant material. Additionally, PRISMA and DICTRA may be used to assess any precipitate fall out and the diffusion of the material into other material.
Wireless connections have several advantages over wired connections; specifically, they are easier to deploy and modify than running cables between the devices would be. Although wireless networks have less bandwidth than wired networks, they are still more than sufficient for sensor data collection. Working in conjunction with our hardware counterparts, we have created a program that runs on the Intwine Connect gateway that receives sensor data from the hardware teams and publishes it to the same interface on the gateway as the data were being published before our project. This has the aim of replacing the existing wired setup with minimal changes to the API. It will also enable a single gateway to collect data from more sensors at once, in contrast to the current limit of two sensors.
For many displaced people around the world, resettlement in another country is the only hope for a better life. After a rigorous vetting process, refugees resettled in the United States are expected to adjust to their new life in a new culture in only a few months. However due to their unique situations, many require specialized care, especially medical care. In our increasingly multicultural society, it is important to investigate the issues and barriers that immigrants and particularly resettled refugees face when accessing healthcare, and also looks at programs and interventions that help accommodate to the needs of these families.

This study examines social, cultural, political, economic, and other factors that influence the abilities of resettled refugee communities to access care. Through a literature review of previous research conducted on refugee communities in the United States as well as semi-structured interviews and observations within a refugee resettlement agency in the Cleveland area, I categorize some of the major barriers to healthcare. This study also examines various programs and interventions that address these barriers and how they can improve the healthcare system for refugee populations.
This review explores the popular myth that men and women communicate differently. While the earliest belief is: “Men are from Mars and women are from Venus,” studies have shown only slight differences between the communication styles of men and women during face-to-face interactions. Studies that claim significant effect sizes in communication styles have helped promote the myth and spread the gender gap. When evaluating these communication “differences,” researchers looked at factors such as cultural and ethnic background, emotional support, length of conversation, and intention to debunk this myth. The study will also discuss how the myth also has gained some truth due to advancements in technology. As technology continues to improve, the number of people who use it also increases. New findings have detected a difference in the way men and women communicate through technology—specifically social media. This difference is not to detract from disproving the myth, but to acknowledge the evolution of the myth and make it applicable to our current generation.
Magnesium DiBoride is a ceramic superconducting material with the highest known critical temperature among conventional superconductors, 39K. This high critical temperature makes MgB2 an appealing material for certain superconducting applications, as it can operate at a higher temperature than other available materials, allowing it to be cooled with a cryocooler rather than with a liquid helium bath. This property would be useful in MRI magnets.

Magnesium DiBoride is a ceramic, and as a result has certain material properties that raise unusual challenges to magnet design. Of particular note is the response of the critical current in MgB2 wires to axial strain. Previous research has established that past a certain irreversible strain limit the critical current degrades rapidly and irreversibly. However, this behavior is not well modeled.

To produce an MRI coil requires the winding of superconducting wires, which requires straining of the wire. Further, an MRI magnet will undergo strains during operation. To ensure that the wound coils will have the expected superconducting behavior the strain on the wires must not exceed the irreversible strain limit. Without a reliable model for the irreversible strain limit in MgB2 wire experimental results must be relied on to provide the strain limit to be respected during the winding.
Thrombus formation leading to blood vessel occlusion is a pathological event in cardiovascular diseases. Therefore, it is critical to remove the clot and restore blood flow to vital organs. One way to remove clots is by administering clot-busting drugs, but this strategy often results in off-target drug action and hemorrhagic risks, which can be minimized by localizing the drug to the clot site. A nanoparticle technology that can bind to active platelets and thereby provide a way to deliver drugs to areas of active platelet localization has previously been developed in the lab. Building on this, the focus of this project is to explore other components of a clot that can enhance nanoparticle targeting beyond active platelet targeting. One component is fibrin, which is the product of coagulation that happens on the surface of clot-associated active platelets. The hypothesis of the project is: Combining fibrin targeting with active platelet targeting can lead to a superior design of clot-targeted vehicles of clot-busting drugs. To test this hypothesis, two different peptides binding to either GPIIb/IIIa or fibrin were evaluated on liposomal nanoparticle surfaces. Resultant peptide-decorated liposomes were studied for their abilities to bind and stay retained on platelet and fibrin rich clots, under simulated blood flow environment using microfluidic chambers. Binding to a non-specific substrate was used as control condition.

In vitro studies show that decorating liposomes with only platelet-binding or only fibrin-binding ligands results in increased binding to clots, and combining these decorations increases their clot-binding ability over time.
The Woranso-Mille (WORMIL) site in the central Afar region of Ethiopia has gained recent importance with the discovery of new hominin fossils interpreted to represent at least two separate species that greatly further our understanding of hominin diversity from 3.5 to 3.3 Ma. Questions remain about the stratigraphic and structural relationships between previously studied locations within the WORMIL site and stratigraphic and structural relationships to surrounding research areas in the Afar region. In an effort to put these finds in the context of regional paleoenvironmental factors, including paleolandscapes and habitats, we are developing a better picture of the area’s geology. We have input location, elevation, geologic, and chronologic data into ArcGIS and analyzed it to determine bed characteristics such as strike and dip. Projection of stratigraphic time horizons marked by volcanic tuffs provide constraints on sedimentation rates and the age of important hominin fossils. Calculated sedimentation rate distributions provide key information regarding the depositional center and regional basin formation, which are important for paleoenvironmental reconstruction. Understanding the paleolandscape diversity of the WORMIL and surrounding sites will provide important insight into possible factors that may influence the apparent hominin diversity during this critical period in time.
Abstract

The marine mollusk sea slug Aplysia californica’s feeding behavior has been studied by looking at activities of large, identified individual interneurons and motor neurons within the buccal ganglion. Using traditional extracellular recording techniques to record action potentials of buccal motor nerves, scientists have characterized how individual neurons contribute to the neural network of rejection-pattern of feeding behavior in Aplysia. We are developing an experimental technique to investigate how motor neurons in the ganglion interact with each other not only as a single unit but also as an entire population. By using two-dimensional, high-density microelectrode array, we are able to locate the active motor neurons within the buccal ganglion during feeding. Combining recordings of buccal nerves, we can identify active motor neurons and then locally manipulate them, and record responses from other neurons within the ganglion as well as changes in behavior. We will incorporate current density analysis and spike-sorting algorithms to provide for the first time a more complete dynamics of a feeding pattern-generating circuit in Aplysia californica.
Latinas/os make up the fastest growing ethnic minority in the United States. Even though the Latina/o population in the United States is bonded together by shared experiences of immigration and uses of Spanish and Spanglish, the group is not homogeneous. Many factors differentiate Latina/o groups from one another. The Cuban experience is quite different from the rest of the United States Latino/a community, having escaped the racialization and stigma that other groups have suffered. Cubans have also assimilated rather well into the country and second generation Cuban Americans are achieving more, in terms of incomes levels and educational attainment, than other second generation Latinas/os. Despite the significant experiential differences between Cuban-Americans and the wider Latina/o community, the increasing use of Spanglish has been reinforcing a pan-Latino identity among young Cuban-Americans and generating more commonalities between them and other Latinas/os.
Cribriform is a pattern found in prostate cancer. The area of cribriform present has shown a correlation with biochemical recurrence. Currently, it is identified manually. This project aims to develop an automated technique that can distinguish the cribriform pattern from other patterns found in prostate cancer histopathology images.

**Abstract**

Found in prostate cancer histopathology images, the cribriform pattern is associated with a higher Gleason score. The quantity of cribriform that appears on a patient's whole-slide radical prostatectomy image (WSI) has been correlated to biochemical recurrence and patient outcome. Out of 44 men who have undergone radical prostatectomy, 7 patients had an area sum of cribriform greater than or equal to 13 mm² (range 13 – 144) on their WSI, all of whom experienced biochemical recurrence. Deep learning (DL), a form of machine learning, was used for the initial development of an automated recognition technique for the cribriform pattern on a patient's WSI. The DL classifier generated by training on 20 patients was tested on 9 patients. The DL classifier output produced probability maps of regions of cribriform that are similar qualitatively to the definite regions of cribriform on a patients WSI.
**Abstract**

The objective of this project was to study the interplay between plasmons and excitons within nanostructured plasmonic micro-cavities. The coupling and the dynamics between these two quasi-particles has generated a great interest in the scientific community for the opportunities offered in terms of accelerated spontaneous emission of quantum emitters and laser action at nanoscale. In general, plasmonic materials are known to have inherently high losses at optical frequencies. I studied how to promote effective and bidirectional energy transfers between excitons and plasmons to compensate optical losses and to induce laser light generation in nanostructured mesocapsules. These mesocapsules are nanoreactors where the plasmon-exciton coupling can be enhanced several orders of magnitude and offer a magnificent scientific arena to learn about a cutting edge research area with implications in healthcare and energy harvesting.
Spinal cord injuries (SCI) are most commonly caused by automobile accidents, falls, or violent acts such as gunshot wounds, etc. These injuries often result in varying degrees of loss of motor function. Because of the variety of injuries and levels of paralysis, different methods of rehabilitation therapy are required, based on the needs of the patient. One rehabilitation program uses functional neuro-stimulation (FNS) to stimulate the extensor muscles in patients. An electrode is implanted into the brain, and signals are sent remotely to stimulate the extensor muscles, allowing SCI patients to perform simple tasks such as standing and leaning. For FNS stimulation, there must be a constant feedback loop to adjust the extensor muscles in relation to the center of mass of the upright posture. Current methods for keeping upright balance rely on the center of pressure of patients using force plates. The method can be improved and cross checked by finding the center of mass results are accurate. Another potential option for body center of mass estimation uses inertial measurement units (IMUs). Three IMUs (two 2g devices, one 4g device) are attached to the body in four different configurations to collect data, which is translated to calculate the center of mass, and cross checked with the marker data. The configurations of both the body mounted markers, as well as the IMUs are tested on three consenting able-bodied subjects. To measure the center of mass, they perform various standing tasks and motions. The results of this study will hopefully lead to developments of future rehabilitation options for people with SCI that are affordable and able to be performed in the comfort of their own home.
This project is for EECS 395, Senior Project in Computer Science. Our program is a web app that gathers data from the energy meters on campus (one by Schneider, the other by Eaton) and converts it into graphs and charts to display on a dashboard for community members and the CWRU Office of Sustainability. These energy usage will be displayed and updated in real time. Additionally, the program will be able to use historical data to predict energy usage trends and provide alerts to registered users if energy usage exceeds a certain threshold. Because the sensor data gathered is stored on a SQL server, we will use a combination of PHP and JavaScript calls to connect to the server where the data is stored. Unlike an already existing, similar app that also displays energy consumption in real-time, this web app won't be exclusively viewable to staff, but instead to both staff and students because it is being publicly displayed, and will display the data in a more easily readable format. We are working with Professor Fietkiewicz, the EECS Faculty Lead for CWRUcible, an interdisciplinary program in the Technology Transfer Office that seeks to develop marketable internet/mobile apps.
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**Title**: Madness in the media: Dispelling the myth of violence in people with mental illness

**Elevator Speech**: Through stereotypical portrayals in fiction and one-sided media stories, the myth that people with mental illness are violent is frequently reinforced. Perpetuating such stereotypes is dangerous, as people who suffer from mental illness are often stigmatized, or even criminalized, and those who need help may be reluctant to seek it.

**Key Words**: mental illness, violent behavior, stereotypes, media portrayal, stigma

**Abstract**: Media portrayals of individuals with mental illness, in both popular fiction and current events, shape public perception and perpetuate stereotypes. Such representations frequently reinforce the myth that people with mental illness are inherently violent. For instance, in popular, fictional representations, characters labeled with a mental illness show a greater likelihood of committing violent crimes. Through an analysis of prior, quantitative evidence and reviews of media portrayals and their effects, the present review examines and refutes the oversimplified belief that there is a causal relationship between mental illness and violent behavior. In reality, it is a combination of risk factors that leads to violence, and one cannot attribute sole causality to a diagnosis of mental illness. Perpetuating such problematic stereotypes is not only fallacious, but also dangerous, as those who suffer from mental illness are often stigmatized or even criminalized. As such, those who need help may be disinclined to seek it due to the potential for stigmatization. In order to effectively combat this stereotype, it is important to reshape public perception, starting with improved representation of people with mental illness in the media.
The human microbiome signifies a vital symbiotic relationship between the human body and a diversity of microbial species. Human microbiota, which develop concurrently with nervous and immune systems, are known to modify nervous and immune functions. Because of the intimate association between human microbiota and these systems, microbial dysbiosis is often observed in nervous and immune disease states. Autism spectrum disorder (ASD) is a neurodevelopmental disease state that is often associated with GI disturbances. Recent studies have further suggested a causal relationship between the gut microbial dysbiosis and the emergence of the disease state, and have proposed the use of broad spectrum antibiotics as a causal mechanism for ASD (Bolte 1998; Finegold 2002; Cao et al. 2013). Other studies have suggested the opposite; advocating antibiotic use as potential therapy for ASD (Sandler et al. 2000; Fallon 2005; Theije et al. 2013). My project aims to create a picture of the relationship between the human microbiome and the nervous and immune systems, otherwise known as the gut-brain-axis; and to reconcile the seemingly disparate claims regarding antibiotic use and autism spectrum disorder.
We have developed a Lung Tumor Motion Simulator, which is a working verification device that simulates the motion of a lung tumor while a patient is breathing. It is composed of an Arduino Due, a DC power supply, a stepper motor mounted on a wooden frame, and a 3D printed model of a lung tumor. Dr. Sohn, an associate professor of radiation oncology, has instigated this project in order to solve an ongoing issue in industry. Currently there is no economical manner to verify whether current CT and radiation oncology systems are accurately tracking lung tumors. We have implemented a control algorithm on the Arduino that accurately steps the motor, moving the shaft and the 3D-printed object in a consistent and measurable pattern. We built and installed a power supply including a 3.3V and 5V DC power regulator. We have begun mathematical modeling of the 3D motion of our system. We have completed the initial testing by tracking our system in a 4D CT scanner. The results show that the tumor model was not captured well in the sagittal plane, and as the size of the tumor was reduced the system was not able to track it as accurately. This result indicates that current CT scanners are not able to correctly capture the motion of a lung tumor. Our lung tumor simulator will act as a verification tool that will allow radiation oncologists to ensure their scanners are acting as expected.
Abstract

Bacterial cellulose (BC) is a biomaterial with a unique, porous mesh structure at the nanoscale. Its highly chemically functional surface has the potential to act as a tailorable substrate for optoelectronic devices. When filled with a liquid crystal, it acts as a flexible substrate for a number of potential optoelectronic devices. When the BC mat is filled with liquid crystals (LCs), our case 4’-Pentyl-4-biphenylcarbonitrile (5CB), the BC mat can be used as an electrically controllable smart window, transitioning from a scattering to a transmissive state. The transition is from a random orientation due to surface anchoring on the mat fibers to a homogeneous electrical aligned state. I will fabricate liquid crystal filled bacterial cellulose mat devices. Our collaborators will produce BC mats that have varied surface properties (for example, hydrophobicity, pore size, etc), which affects the surface anchoring energy, fill the BC mats with 5CB liquid crystal, and make confined cells. I will perform dynamic switching and other optical measurements using BC mat samples with various surface modifications and pore sizes. The light transmission properties of the BC mat samples will be measured using the laser setup, and the data are modeled using the standard and modified Boltzmann functions.
Abstract

Tokamak fusion reactor design is heavily influenced by the desire to mitigate heat flux to the vessel walls. Reducing this is important to minimize the amount of metal sputtered from the wall into the plasma, which lowers the temperature, and to extend the lifetime of the reactor. One phenomenon of concern that can eject large amounts of plasma, and in extreme cases cause a catastrophic loss of plasma confinement, is an Edge Localized Mode (ELM). Recent research using data from several tokamaks around the world has shown that some ELMs are preceded by fast ions losses; however, the mechanisms by which ELMs cause fast ion losses are not well understood. A recent upgrade to the FILD) on the DIII-D tokamak allows for higher fidelity measurements of the Energy and Pitch -Angle of escaping energetic ions. The data gathered by the FILD probe in the upcoming experimental campaign, in conjunction with other diagnostic data, will be used to investigate the underlying physical relationship between fast ion losses and ELMs.
Abstract

Chiral liquid crystals have been an area of growing interest. These materials have phases where the molecules are not rigidly confined as in a crystal but maintain more order than in a liquid, ranging from preferred orientation of the molecules to partially fixed orientation within layers. Chirality, a lack of mirror symmetry, in certain liquid crystals gives rise to various useful properties including ferromagnetism and temperature dependent reflection of light. There have been several recent studies into inducing chirality in liquid crystals, either dispersing a chiral material in an achiral liquid crystal host or imposing boundary conditions on the liquid crystals which result in chiral structure which spreads into the bulk. The goal of this project is to demonstrate chiral induction due to dispersed chiral micro and nanocapsules in an achiral liquid crystal host. These capsules are polyuria shells composed of L-lysine, created by the chemistry group of Professor Raed Abu-Reziq at the Hebrew University of Jerusalem, Israel. We measured the chiral induction strength of the dispersed particles in the achiral liquid crystal 4-cyano-4-pentylbiphenyl (5CB) using domain wall curvature effects in a twisted cell geometry, where curvature acts as a measure of chirality. Comparing the average curvature between samples of 0%, 0.11%, 0.21%, 0.32%, 0.42%, and 0.52% by weight concentration of capsules in liquid crystal, we demonstrated a trend of increasing curvature with concentration and thus increasing chiral induction strength.
Autism spectrum disorder (ASD) represents a group of complex neurodevelopmental disorders that are characterized by repetitive behavior, characteristic patterns of behavior and hindered social and communication interactions. Severity ranges from mild to severe and is defined by a spectrum of symptoms, abilities and disabilities. Causes and factors that could affect the prevalence of autism have been studied, including if race or ethnicity play a role in the likelihood of a diagnosis. This has been disproved, but has lead to research that brought attention to the lack of resources, such as screening practices and early intervention-based methods available to minority children and families.

With autism, the time that a child is diagnosed is crucial in determining the mitigation of symptoms and improving quality of life. In racially diverse populations, children are diagnosed years later than their White counterparts, inhibiting their chances with coping and thriving. The overwhelming overrepresentation of White children with autism sheds light on the lack of quality resources available to minority families that lead to the overall detriment and inability for optimal success.
Abstract

Ferrous Engine is a Unity game engine add-on that allows developers to perform magnet simulations in their games. Developers will be able to add Ferrous Engine scripts to their game objects, such as Magnetic, MagneticSurface, and BarMagnet. The game objects will behave similarly to the associated magnetic object. Lodus is a 2D platforming/puzzle game that demonstrates Ferrous Engine’s features and exploits magnetic properties to provide an enjoyable and challenging game experience. Users will navigate a world of magnetic platforms and puzzles using their only weapon and tool, a bar magnet staff. The game and engine will implement simulations of real-life magnetic properties using C# scripts and HLSL/Cg shaders. The engine will be offered as a Unity package, and the game will be available on the free game-hosting service itch.io.
Musical Theatre Intervention Program Effectiveness: Peer-to-Peer Interactions in Children with Autism Spectrum Disorder

Children with Autism Spectrum Disorder (ASD) have trouble with different aspects of social development. Children with ASD may experience complications with social interactions, repetitive behaviors, and both verbal and nonverbal communication. As a way to reduce the risk of social isolation and peer rejection in both females and males, various forms of intervention and therapy programs have been created to improve social deficits. Intervention programs utilize a variety of methods to determine if the children can benefit from gains in social engagement and understanding and eye contact. The purpose of this study is identify if The Musical Theatre Project’s (TMTP) use of the Kids Love Musicals! (KLM) had an effect on peer-to-peer interactions when considering the variables school site, age, and gender. The KLM residency program is a 4-week in-school program, administered by two teaching artists, with twice a week sessions delivered either during the school day or after school for 30-45 minutes. Thirty (n=30) students (grades 9-12) with ASD participated in the study. Videos of the TMTP are coded for the variables peer-to-peer eye contact, initiation, and response. I hypothesize that females and males will have similar gains in peer-to-peer interactions based on results from previous studies. However, I predict that females will have a higher frequency of initiations and responses in comparison to the males. Conducting this research is significant because the communication skills that are developed through completion of a musical theatre intervention program can be determined to aid improving social skills in children with ASD.
Two of the biggest problems faced by quantum computing are: creating stable coherent quantum states that will last long enough to perform computations, and the individual control of these states. With magnetically coupled Nitrogen vacancy centers (NVs) and ferromagnetic (FM) vortices, these difficulties can be greatly diminished due respectively to lattice shielding and large magnetic field gradients. Directed by a microwave frequency field, and affected by the potential and defects of the FM disks on which they lie, FM vortices are moved to varying distances from the NV, varying the experienced magnetic coupling. Using differential magneto-optical microscopy, a map of the FM disk's potential is created (forming a greater understanding of its movement), and using optically detected magnetic resonance spectroscopy (ODMR), the NV-FM vortex coupling is mapped. Using this information, the ferromagnetic vortex is used first the first time, to demonstrate the coherent adiabatic passage of a single NV spin qubit.
Abstract

The primary objective of this research study was to uncover a protein source’s role in the development of obesity and obesity’s complications, primarily cancer. It was hypothesized that obesity could lead to the development of breast cancer, colon cancer, and ovarian cancer in obese species. In order to better understand the role of protein source in the development of obesity, the research study used both lean and obese rats on two different diets: a soy diet, selected due to the fact that Asian women, who tend to consume more soy, have a decreased incidence of breast cancer; and a casein diet, a more western diet, that has 30 percent less protein content than soy. The objective was to look at the amount of protein in an organism on a specific diet, as well as the mRNA within that species to determine whether there was less protein, more protein, protein with a faster degeneration rate, or even altered protein. Besides protein, other substances particularly, Magnesium, Zinc, and Iron were looked at in relation to the protein source due to the role that these elements play in metabolism. The research was aimed at revealing whether casein or soy lead to a decrease in Magnesium in an organism which in turn could lead to a liver metabolism switch from glucose utilization to fatty acid utilization, which can cause the development of a fat liver. The metabolic utilization of Fatty acids also causes inflammation of the liver which leads to obesity and liver damage.
In this study, we attempt to establish the reliability of the Infrared Dual-mode Heat Flow Method (IR DMHFM) of measuring the thermal conductivity of materials, towards the aim of characterizing unknown materials, specifically Cellulose Nano-crystals (CNC’s). The measurement is made in vacuum, reducing the impact of convective losses on the process of heat flow. An Infrared thermometer is used to determine the temperature profile along the direction of heat flow through a 1-D sample. To determine the sample thermal conductivity, the measured temperature profile is compared to a numerical solution of the heat flow equation that includes both conduction and radiation. The majority of investigation is dedicated to assessing the accuracy of the thermometer in different temperature regimes, as well as accounting for differences in the emissivity of both the materials being measured. Methods for establishing the credence of emissivity values are examined, such as calibration with a separate thermocouple and a dedicated emissometer. Discussion is then made on the computer analysis procedures used to obtain numerical results. Finally, measurements will be made on known materials to confirm that all aspects of both the experimental and analysis methods will provide an accurate measure of unknown materials.
**Abstract**

The Cosmic Microwave Background, relic light from shortly after the Big Bang, is hypothesized to have a characteristic polarization imprinted on it by the gravity waves propagated during the early universe's epoch of inflation. This polarization, which has been constrained to be very small relative to the total intensity of the Cosmic Microwave Background, is also difficult to distinguish from the polarization caused by galactic dust. Signal quality can be optimized by comparing different arrangements of detector bands in order to find the best one. This is done using a Monte Carlo simulation using simulations of the CMB with accepted cosmological parameters. By doing this many times over, each time with a new noise map, for each possible detector arrangement, the arrangement with the least variance in key fit parameters is found. This will give the Spider Collaboration the best sensitivity to the polarization caused by primordial gravity waves.
Peppermint oil has been used as a remedy for indigestion, nausea, pain, and a number of other medical symptoms. Recent years have seen more studies examining the benefits of peppermint oil in Irritable Bowel Syndrome (IBS), endoscopy induced spasms of the gastrointestinal (GI) tract, and also its potential use as an analgesic. Peppermint oil has anti-spasmodic, anti-inflammatory, and anti-microbial effects. Its mechanism of action is primarily the blocking of calcium-channels in the smooth muscle cells of the GI tract. While the benefits of peppermint oil have not been established beyond a reasonable doubt, after careful review and consideration of the results of past and recent studies, peppermint oil has shown to be a promising tool in the future of medicine and the science community is taking more steps to study it.
Auditory masking is the disruption of the ability to hear one sound (the target) because of the presence of another sound(s) (the masker). There are different types of auditory masking. Energetic masking is due to spectral and temporal overlap in excitation patterns between the different sounds within the inner ear; informational masking, meanwhile, is thought to occur at higher levels of the auditory system (the brain) and causes the listener difficulty in separating the target from the masker. In our research lab, we study informational masking using competing speech as the masker. Specifically, we typically use two competing talkers as the masker speech. In 2007, Freyman and colleagues reported unexpected variability between various different two-talker maskers, whose only significant difference was the voices used to create each masker (i.e., the masker talkers were speaking the same speech materials). In the current experiment, we will measure the effectiveness of six different two-talker masker combinations created using four different masker talkers. We will measure acoustic features of each talker’s speech (e.g., speaking rate, pitch of voice, measurements of vowel productions) in order to try to understand the variability across masker conditions. In addition, we will also investigate the potential role of subjective-perceptual similarity between masker and target talkers and determine how subjective ratings of similarity relate to observed informational masking. Current models of informational masking suggest that greater masker-talker similarity causes increased informational masking. Until now, no study has explored whether subjective-perceptual judgment of similarity can explain variability between masker conditions for informational masking.
Completely rigid tires have a history of failing to efficiently traverse Mars' terrain and due to Mars’ low temperature, atmospheric pressure, and lack of accessibility, traditional rubber pneumatic tires are not feasible. As a result, a new form of tire design has to be developed for a future NASA rover vehicle utilizing a stiffness varying concept. The ability to vary the stiffness of a tire increases the longevity and the ability of a vehicle to drive over a wide variety of terrain. The most recent Mars rover, Curiosity, used rigid tires machined out of a single billet of aluminum in attempt to limit weight and increase simplicity. These tires are currently exhibiting degradation when coming in contact with some of Mars’ rough terrain. In order to overcome this issue, NASA developed a compliant tire with inter-woven springs. The “spring tire” design offers the advantage of being able to conform to various terrains elastically while limiting permanent damage to the tire. Simultaneously, occasional plastic deformation of a few springs still leaves the tire as a whole operable. In an effort to examine the variable stiffness implementation of the “spring tire” design, the effect of changes in tire width are examined using a sectioned full-scale spring tire. The Proof of Concept model is assembled in accordance with NASA’s build specifications and material selection. Using a compression rig, the deflection under load associated with certain tire widths are measured. By developing and testing a proof of concept for the variable stiffness tire, we are examining a relationship between stiffness, tire width, and the number of effective springs, which can be incorporated into a future Mars rover tire design.
The brain is active even in the absence of stimulation. Its spontaneous activity is not random but highly structured and can be used to investigate properties of neuronal circuits, for instance, functional connectivity, which is crucial to understanding how neuronal circuits process information. To address this question, it is necessary to record from large populations of neurons simultaneously, and overcome the traditional tradeoffs between spatial and temporal resolutions of standard electrophysiological and imaging methods. We attempt to solve this problem using high-density, two-dimensional, multielectrode arrays (MEA) to investigate spontaneous activity from the mouse neocortex in vitro. The arrays consist of 120 electrodes evenly spaced with 100 um pitch over an octagonal area spanning over 1.2 × 1.2 mm². This technology enables the study of activity patterns with unprecedented temporal and spatial resolutions in cortical circuits. Using spike-sorting algorithms, action potentials from multiple cells can be resolved from each electrode in the MEA, so that we can potentially identify on the order of hundreds of neurons in a single experiment. In preliminary studies, the neurons displayed different types of spontaneous firing patterns over a wide frequency range, from less than 0.1 Hz to more than 100 Hz. Some neurons fired tonically, some transiently, and some in regular bursts. From the firing patterns, we were able to investigate functional connections between neurons at different locations in the neocortex, and identify neurons with important roles in the network. These results open up a new avenue to investigate the activity and functional connectivity of neural circuits.
Children with Prader Willi Syndrome have been shown to have social deficits and deficits in regards to pretend play. Pretend play is often an indicator of overall social skills for children. Therefore, children who produce imaginative play often times are more socially adept. While we do know that children with PWS don’t play well, we are interested in finding what specific skills they have challenges with. The purpose of this study is to evaluate what problems with interpersonal skills children with PWS face on a day to day basis. Video data of test sessions will be reviewed for a test sample of 19 children with PWS and a control of 19 typical children. We will code for a frequency count of personification within play, whether or not the play is aggressive, nurturing or neutral in nature and an overall count of characters used. It is hypothesized that children with PWS will use less personification in their play and the number of toys interacting will be less than typical children. This research will help to show what deficits are felt by children with PWS and will help develop appropriate interventions.
Multiscale Aspects of Neuronal Dynamics

Abstract

A spontaneously spiking acute brain slice was prepared and observed from over 100 distinct recording sites with 100 um precision using microelectrode arrays (MEAs). Stable contact with the tissue allowed for the long-term observation of high SNR extracellular activity. The activity was diverse and spanned multiple time scales. Neurons exhibited regular firing in high frequency bands (20-70 Hz), but also displayed regular bursting in alpha and theta bands (5 and 8-12 Hz). Spike events were treated as counting processes. Matrices of pairwise neuronal firing were computed across multiple timescales ranging from the discrete spike events (0.001 s) to rate-encoded activation (30 s). From the fastest to the slowest timescales, the network connectivity progressively morphs from a sparse network into two densely populated competing networks that are spatially segregated.
There is currently a large gap that exists between high cost, exceptionally insulating coolers, such as YETI® coolers, and low cost, poorly insulated coolers in the recreational cooler market. The current cooler market does not offer consumers a good quality, cost effective cooler. Using both materials selection and a centrally cooled cooler design, we aim to optimize the cooler cost and insulation properties in order to produce a cooler that fills the need for a cheaper, quality product, which we call Centra-Cool. The goal of this project is to optimize our cooler in order to achieve insulating properties similar to the high-end models at a reduced price. The first optimization tool used is materials selection. Materials selection allows us to choose the lowest cost material for our cooler based on a variety of processing and insulating constraints. The second tool for optimization is the application of a centrally cooled concept to the cooler design. The concept mimics water bottles with frozen stick that are inserted into the center of the bottle. By creating a cylindrical section in the center of the cooler designed to hold ice, the cooler will be able to cool its contents from the inside out, thus increasing the efficiency of the ice along with the added benefit of providing users with chilled, dry contents. The application of these two optimization techniques will allow us to produce more affordable, highly performing coolers.
In 1969, a Peruvian telenovela called Simplemente Maria touched off an academic conversation about the effect of telenovelas on viewer behavior by inadvertently motivating hundreds of viewers to enroll in literacy classes and purchase Singer sewing machines. In the 1970s, Mexican producer Miguel Sabido harnessed the Telenovela Effect by creating a series of telenovelas that deliberately conveyed messages about public health and aimed to change viewer behavior. His Entertainment-Education model has since been replicated around the world with varying levels of success. This paper attempts to quantify the factors that are required for a successful entertainment-education public health program by analyzing the successes and failures past campaigns in an anthropological, sociological, and mythological framework. Telenovelas impact their viewers in two ways: by encouraging changes in individual behavior, and by shaping collective attitudes and social norms. However, their success depends on both an effective plotline and a receptive audience. The plotline must successfully link health issues to broader social behaviors and attitudes, imbue intellectual content with emotional significance, and take place in a cultural context that resonates with local viewers. Furthermore, the audience must have sufficient media saturation to ensure that the telenovela stimulates interpersonal conversation about the relevant issues, and must have the capacity to act upon the messages portrayed in the telenovela. This paper explores the telenovela as a modern myth and examines the ways that storytelling can be practically applied to shape public behavior and belief.
Domestic violence is becoming one of the most common problems in modern society that negatively affect people’s lives. When mentioning domestic violence, people usually think about physical abuse as the only type of violence. However, according to past researches, people are undergoing not only physical abuse, but also other types of violence that people are not familiar with. This project analyzed different types of domestic violence existed in modern society that could be easily ignored including verbal abuse, emotional abuse, sexual abuse and financial abuse. The study goal is to help people realize that domestic violence is not only physical and at the same time, improve people’s coping mechanisms when they are facing domestic violence.
### Title
Chemical-vapor-deposition growth of Tin(II) Sulfide (SnS) nanowire

### Abstract
Tin(II) Sulfide has drawn some attention during the last few decades as a potential material for solar cells, because of a bandgap of 1.05 – 1.5 eV and a relatively high absorption coefficient of 104 – 105 cm⁻¹. The low cost, nontoxic material has shown promising electronic properties on bulk crystal of thickness from tens of nanometers to few hundred nanometers. However, little work has done on 2-D SnS material. This project focus on growing few layer SnS films and nanowires using chemical vapor deposition and studying the distinctive electrical and optoelectronic properties of this 2-D semiconductor.

SnS could be an alternative material for field-effect transistors that are currently dominated by Silicon. SnS is nontoxic, easy to scale down in size and has promising electrical and photoelectrical features.
### Abstract

This research project would examine the theoretical speedups that quantum computers could have solving problems with underlying periodic abelian algebraic structures and the reduced and derived structures thereof. Most significantly as examples, the integer factorization problem, and, more recently studied, lattice problems such as shortest vector problems (SVP) are targets of examination. The project aim to explain and extrapolate the ideas from the notable of quantum algorithms that Shor, et al. developed to solve integer factoring as well as attempts to tackle lattice problems. Beyond this goal, the project would try to explore and extend more regarding lattice problems in quantum realm in the hope of solidifying some ideas of the current framework Eldar and Shor proposed, and potentially examine some other problems and structures in addition.
Abstract

Cardiovascular diseases and diabetes are the leading causes of death not only in the United States, but also in many industrialized societies. With limited resources and technological methods, only a minute amount of information regarding the relationship of these two epidemics had been discovered. Studies demonstrate that diet and lifestyle can greatly influence the acquisition and development of both CVD and T2DM, and importantly diet and exercise also influence the acquisition and development of the gut microbiome. However, with the commencement of the Human Microbiome Project in 2008 and the aid of advancements in molecular techniques, the crucial role of the human gut microbiota has become much more evident. Numerous research studies have demonstrated how disturbances in the gut microbiota may lead to CVD or T2DM. The role of the human gut microbiota may be a critical link between CVD and T2DM and supports the fact that people with T2DM are more likely to develop the risk factors associated with CVD compared to healthy individuals. Continuous research on the human microbiome may lead to future medical treatments and practices targeted specifically towards the gut microbiome and improve the health of patients with risk factors for CVD and T2DM.
Flanking math, don’t worry your right side is running the show. That art assignment dragging your GPA down, the left brains got your back. If this were true life would be simple. Unfortunately, our brains are much more complicated and interconnected than that, shaping who we are in unexpected ways.

Key Words
- Hemisphere Dominance
- Left/Right Brain
- Myth-busting

Abstract
Are you left brained, analytical and rational, or are you right brained creative and free flowing? Many may already have an answer to this question or at least if pressed would easily be able to assign themselves into a category. In the odd case that you cannot do it alone, there are a myriad of tests online and self-help books that will purportedly determine the answer for you. A diagnosis of this sort may bring comfort to some who struggle in the respective fields that have been assigned to the side of their brain that isn’t “dominant” but, sadly the science does not back up any of these claims. Our brains are a complex organ. In certain fields, one’s left or right hemisphere may do the majority of the work, but it is the interconnectivity of our brains that allow us to perform to our fullest capacities. In truth if we were either right brained or left brained we would be unable to fully express ourselves or see the beauty in this wonderful world of ours.
Criminal profiling is the method of taking patterns and past behaviors to identify potential suspects of a crime. Additionally, this analysis is used to predict when and where future crimes will be committed. Unfortunately, these analyses are not as accurate as they are portrayed to be on television shows such as Criminal Minds. While they can occasionally provide helpful insight, there is no true merit in identifying tendencies in an individual to predict what they will do next. The hope is to shed light on this subject to not only explain how profiling works, and what it could potentially be used for, but also to identify why there is a misconception in the public eye about its effectiveness. However, due to the nature of profiling, it is difficult to consistently test. This has led to small, mostly unrepresentative studies that prove its efficacy being thought to truly represent the field. Eventually, the public will be enlightened in the same manner as law enforcement.
As knowledge of quadruped mobility and developments in mechanical assistive devices have improved, veterinary orthotics and prosthetics has emerged as a sub-field of veterinary medicine. When treating cranial cruciate ligament injuries in dogs, orthotics are commonly used for post-surgery rehabilitation or as an alternative to surgery. The popularity of this treatment has revealed a need for an anatomic, external knee joint particularly for large dogs weighing 105 pounds or more.

The current practice is to adapt existing knee joints for humans, and incorporate them into canine braces. While many techniques and materials from human orthotics and prosthetics can be translated to the veterinary field, specific adjustments must be made to suit the canine’s unique anatomy and motion. Without the proper modifications, these joints are often not robust enough to support the weight of large dogs and limit the dog’s natural knee flexion. Therefore, the goal of this project is to design a robust, lightweight, and inexpensive anatomic knee joint that limits knee extension to 150°. Ideally, the joint will be adjustable and thereby, customizable to every patient.

Based on customer needs, derived requirements and criteria were developed to analyze joint mechanisms that could be used in the conceptual designs. The criteria mandate that the mechanism mimics the natural joint movement, be adjustable and robust, and limit the joint’s range of motion. A Pugh Chart was used to evaluate and select conceptual designs incorporating the Condylar and Four Bar mechanisms. These were further developed in the detailed design phase, which included 3D modeling and finite element analysis of the joint construct. After producing and testing prototypes, a final design was recommended. Supporting documentation included detailed models and drawings.
Penicillin binding protein (PBP1b) is a protein found in the periplasm of antibiotic resistant strains of bacteria. PBP1b is an essential component of bacterial cell wall synthesis. In addition, PBP1b has been shown to be activated by LpoB (lipoprotein activator). When complexed with LpoB, PBP1b plays a crucial role in formation of the cell wall. Thus, PBP1b inhibitors are a phenomenal area to research as possible antibiotics for this specific antibiotic resistant strains of Escherichia coli.2 Conversely, heat stable enterotoxin (guanylyl cyclase C) is a receptor protein that plays an important role the onset of pathogenic E. coli inducing bowel distress or clinical traveller’s diarrhea. Expression of guanylyl cyclase C is difficult to produce in levels sufficient for X-ray crystallography imaging. Our data suggests that the fusion of both PBP1b and GCC to KPC2 boosts protein expression. Further refined purification techniques can provide a greater protein yield of the fusion protein GCC-KPC2; therefore, increasing the likelihood of quality.
The purpose of this project is to increase the reliability and reduce the current 2% in-process non-conformance rate of the ball retention stake feature of the Jergens Kwik-Lok Pin™ through the product stake feature in conjunction with creation of new manufacturing methods and tooling. The Kwik-Lok Pin™ is used for holding parts together where the feature of quick removal is also required. The design is applied in various situations, such as stage audio equipment and aerospace manufacturing. Jergens reached out with this project to see if new inventive solutions could improve the reliability of their current design. Currently, stamping each side individually is considered the fastest and cheapest way to create the stake. While previous attempts have been made Jergens Inc. to improve the reliability of this staking method, they have been met with mixed results. The goal of this project is to go beyond those past attempts, and increase reliability without sacrificing manufacturing cost or speed. Our project group tackled this design problem by separating it into two separate categories, one comprised of the shape of the stake feature and the other focusing specifically on the staking procedure and centering the pin on the machine. These categories were addressed individually so that our group was able to maximize the number of prototypes in the available time frame. This approach resulted in two separate designs with interchangeable components. The first design considered was a die stamp with interchangeable staking profiles. We assessed each prototype by testing the end products to ensure they can maintain the stresses and forces they would experience in various consumer applications. After the products pass this test, the cost and speed are considered with relation to the current production line. All in all, our project succeeded in making a new process that allows for different staking profiles aimed at increasing the reliability of the part.
The Bayesian Autonomous Broadcasting System is an intelligent, heavy-duty sentry robot based on a tracked wheelchair platform for navigating difficult terrain and performing mission specific objectives. Development of the project was through overhauling the main hardware and computer power supply systems, adding anomaly detection software, and whole-system integration of a wobbling LIDAR for point-cloud processing. Through the combination of multiple 2D and 3D LIDAR sensors, cameras, GPS, and thermal imaging systems, the robot is intended to perform independently of outside control to achieve broad high-level goals. Crucial improvements made include overhauling the main hardware and computer power supply systems (24V and 12V), adding anomaly detection software, and whole-system integration of a wobbling LIDAR for point-cloud processing. Additional progress includes building a thermal camera imaging subsystem, renovating hardware and wiring the main chassis, and establishing software documentation and testing for future users.
This study aims to recognize that in designing load-bearing craniofacial bone substitutes an animal model is needed that allows for assessment of minimum biomaterial strength requirements when reconstituting defects in load-bearing sites. This study demonstrates that aradicular hypsodont (continually growing) dental morphology in rabbits provides a physiologic & quantitative measure of mastication that can be predictably altered with a specific unilateral mandible defect. In a pilot study of 5 NZW rabbits, unilateral [hemi]mandible bone and/or neural defects were made with the intent of understanding the effects of various mandibular insults on mastication. Defects ranging in size from 8mm (critical size defect) to 25mm were placed either in the tooth bearing or muscle bearing mandible body. The inferior alveolar neurovascular bundle was severed in one subject. Measured outcomes were dental & defect morphology as measured by x-ray and mechanical testing of explanted mandible specimens. Dental morphology of animals with defects that extended to the oblique line resulted in distinct ipsilateral dental morphological changes reflecting masticatory neglect. Sensory deinnervation had a greater effect on cheek teeth (molars). Altered masticatory function appears correlated with ex-vivo measurement of bone strength and stiffness. The dental morphology of rabbits appeared to correlate with physiologic function which is associated with the structural integrity of the hemi-mandible. Furthermore, structural integrity can be reversibly compromised with specific defects of the hemimandible and quantified ex-vivo. These results suggest that dental changes from a defect can provide a quantitative measure of hemimandibular strength.

There exists a clinical need for bone substitutes that can provide functional load-bearing strength in the craniofacial skeleton. Currently, there is no animal model with which to functionally assess the mechanical properties of biomaterials. Addressing this absence, our animal model will facilitate development of biomaterials to reconstruct craniofacial bony defects.
We have outfitted the community garden on East 84th Street with an automated, solar-powered irrigation system, along with other repairs to the garden. This project is expected to run just over $1,000 and will be important to the community, bringing the nearby residents fresh vegetables and herbs instead of the fast food that's nearby.

**Abstract**

We have outfitted the community garden on East 84th Street with an automated, solar-powered irrigation system, along with other repairs to the garden. The current rainwater collection system and hand pump had been damaged and outright unused by the community. Our irrigation system needs to automatically water fifteen, three-foot wide beds. We're using 360-degree mist heads to effectively distribute water in the garden beds. The pump and controller need to run on DC power for simplicity and the controller must be able to switch between 4-6 different zones to lower the power requirement of the pump. Our irrigation system will cost a little over $1,000, which includes garden edging to keep out weeds and chicken wire to keep out trash. This project will allow the nearby community to benefit from fresh vegetables and herbs without any commitment passed initial planting.
People have been drinking wine for thousands of years. From the beginning, wine education has been passed down through apprenticeship between vintners, those who make and sell wine. This education, based on the experience of growing and harvesting grapes, is known as viniculture, and involves everything from how to produce delicious wines to understanding the various pairings of wine with food. Only recently has a scientific and systematic process for the study of wine developed. This field, known as oenology, focuses on researching the science of wine. The chemistry involved in the winemaking process is extensive and complex, itself a scientific laboratory endeavor. The study conducted here examines the chemistry involved in winemaking, as well as the high potential of the various and currently underutilized applications of chemistry to winemaking. A single type of wine can contain over 400 different aromatics, responsible for a wine's taste, smell, appearance, and character. Knowing the chemistry behind the production of wine can help winemakers improve their wine quality and production processes to be more efficient and environmentally cautious. In addition, the chemistry behind taste is important for those who want to create pairings of food and wine. Chemistry is also being used to explore the debate around whether wines should have sulfites added to them and how that affects their quality. One final incredibly important application of chemistry to winemaking is the mapping of the distinct metabolites found in each type of wine, allowing winemakers to create unique wines and identify counterfeits. Overall, the field of oenology continues to change the dynamics of winemaking to be more scientific and systematic; these improvements will help viticulturists methodically produce unique wines in a way that constantly improves wine quality and minimizes environmental harm.
Endonasal septal perforation repair using posterior and inferiorly based mucosal rotation flaps

Background: Repair of septal perforations is challenging regardless of surgical technique due to location and poor tissue surrounding the perforation. We report a method of closing anterior perforations using an inferiorly based mucosal rotation flap and an acellular dermal interposition graft.

Methods: Forty-one patients with septal perforations of various size and etiology underwent endonasal repair using rotation flaps. Five patients had perforations such that we used inferiorly based flaps.

Results: Thirty-six of the forty-one patients experienced complete closure of their perforation, an 87.8% success rate. Perforations were separated based upon size. Small perforations (<1 cm) had an 86.7 percent success rate, medium (1-2 cm) 84.2 percent, and all 7 large perforations (>2 cm) were closed successfully. In addition, all five of the inferiorly based procedures resulted in complete closure of the perforation. Of the failed repairs, 2 required additional surgeries to repair recurring perforations while 2 were completely asymptomatic following the procedure.

Conclusion: Endonasal repair using inferiorly based mucosal rotation flaps coupled with an acellular dermal interposition graft is a valid technique for the repair of septal perforations. Posterior rotation flaps are preferred due to major septal blood supply from the sphenopalatine artery, but inferiorly based flaps are shown to be viable options for repair given perforations located in the anterior region of the septum.
The expression of the androgen receptor (AR) has been established in phenotypic studies of triple-negative breast cancer cells undergoing epithelial-mesenchymal transition (EMT), an essential program in cancer metastasis. This study examined whether AR inhibition can replace traditional hormonal and human epidermal growth factor-2 targeted therapies.

Human MDA-MB-453 breast cancer cells and murine NMuMG mammary epithelial cells were stimulated with transforming growth factor-beta (TGF-beta) to induce an EMT program, which resulted in robust AR expression that contributed significantly to the metastatic, organoid outgrowth in 3-dimensional models quantified by longitudinal bioluminescence. In addition, we also found that stimulating MDA-MB-453 cells with dihydrotestosterone resulted in the activation of TGF-beta-responsive luciferase reporter genes, and in the phosphorylation of TGF-beta-responsive transcription factors, Smad2/3. Gene expression levels were determined by means of real-time PCR with decreased levels of epithelial markers, including E-cadherin and ER-alpha, and increased levels of mesenchymal markers, N-cadherin and beta-3 integrin being observed as the cells became more tumorigenic. The prevalence of AR was found to inversely correlate most notably with ER-alpha, suggesting a transition in hormonal dependence between these two steroid receptors.

Taken together, these results show that targeted suppression of the AR offers potential to counteract TNBC development and progression; we further demonstrate the balance between AR and ER-alpha to be indicative of malignant growth, with the high frequency of AR expression in post-EMT cells correlating with an inhibition of ER-alpha mediated activities. This exchange may contribute to the apparent resistance of TNBCs to hormonal treatment with drugs such as Tamoxifen; further studies are necessary to elucidate the mechanisms behind this shift.
The purpose of this experiment is to compare several kernel learning strategies in terms of classification performance and execution time. The Multiple-Kernel Learning (MKL) approach utilizes learned kernels implemented as convex combinations of base kernels. The learned feature kernel approach is a variation of MKL where the number of base kernels equals the number of features in the input data, and each base kernel is constructed with respect to a single feature. In the stacking approach, a collection of classifiers are trained independently, and the resulting predictions are used as the training data for a new classifier. In this way, the new classifier learns the optimal combination of the base classifiers. The experiment seeks to establish how these learned combinations compare to each other and to the base kernels. The metrics used to determine this will be the area-under-the-curve (AUC) and balanced accuracy scores. If time permits, the experiment will be extended beyond the current supervised learning setting to include multiple-instance learning.
The team noticed that many working professionals have spent a large amount of time on trying to memorize what files they used and changed in different meetings, and we decided to develop Kiki, a meeting assistant application, to minimize this unnecessary cost of time. Kiki is a smart meeting assistant based on Google Calendar, which assists users with keeping a record of file changes in different meetings scheduled on the Calendar. With this assistant, users will be able to see what files they used during a specific meeting. These files are retrieved from recent file history according to meeting time or attachments of the meeting. In addition, for each file, users will be able to see a list recording in which meetings this file was created, edited or deleted. The application aims to help the users who are flooded with meetings and file changes to organize and plan their works more efficiently.
Cosmic rays are the most energetic particles in the universe but we do not know where they are coming from or how they are produced. Answering these questions will lead to a deeper understanding of the universe and how it functions.

The overall goal of the project focused on understanding the nature and origins of cosmic rays, the most energetic particles in the universe. In order to further this goal work was completed in an initiative between the Pierre Auger Cosmic Ray Observatory (Auger) in Argentina and the Telescope Array (TA) in Delta Utah. These two research stations use different methods of detection and have been yielding slightly different results, leading to questions about what is causing this discrepancy. The cause of these differences might be rooted in different detection or analysis methods, unconsidered systematic differences between detector responses, or the placement of the TA and Auger stations in different hemispheres of the Earth. If the difference is caused by positioning it might indicate that cosmic rays are propagating at different rates from different sections of the universe giving a clue to their origin. In order to understand this discrepancy the two collaborations need to be able to compare data and detection methods of the two different setups. To facilitate this a set of detectors have been deployed at the TA detection site but are being monitored and analyzed by members of the Auger collaboration. This poster focuses on the construction, testing, and calibration of detectors and their support systems that are now deployed in the field at TA.
Fungal infections, harmless to most healthy individuals, can be fatal in immunocompromised patients. Currently, T-cell mediated immune responses during fungal infections is incompletely understood. This project analyzes the relative production of pro-inflammatory and anti-inflammatory cytokines in response to Candida albicans infections, in antigen stimulated T-cells. We report initial analysis that shows C. albicans leads to an increase in anti-inflammatory cytokine interleukin-10 (IL-10) and a decrease in the pro-inflammatory cytokine interferon-? in cell cultures. These results imply that therapies which enhance or counter these cytokine changes could potentially aid in successful treatments of chronic C. albicans infections. Further research is being continued to determine the precise functions of these cytokines and T cell subsets during the infection.
Abstract

Open shell systems such as dn in transition metal and fn in lanthanides are complex because the interaction energy of the electrons depends on the many different ways the electrons can combine their orbital and spin angular momenta. These different states for a given configuration are called multiplet states. Their calculation in free atoms and ions has been addressed in quantum mechanics many years ago but is still relevant as a first step to better understand their interaction with the states of the solid surrounding them when implanted in semiconductors or other optical materials.

In this poster we revisit the calculation of atomic spectra of these elements. Because the potential in an atom is approximately spherically symmetric, its individual electron wave functions are products of spherical harmonics and radial wave functions. The many-electron states depend on how the angular momenta combine and require diagonalizing the Coulomb interaction part of the Hamiltonian. Part of this problem involves the somewhat complex mathematical formulation of angular momentum addition.

We carried out this procedure for a few simple cases d2, d3, f2 but ultimately rely on the expressions derived by Racah in the 1940s for the more most general cases.

The remaining ingredient in these calculations are the Slater F-integrals which are double integrals over the radial wave functions with powers of r. We then focus on how to calculate these from density functional theory based atomic wave functions from both free atoms, ions and atoms in their solid environment and compare them with tabulated results in literature, which use Hartree-Fock theory. To determine which of these various ways of calculating the Slater F-integrals is more accurate we compare directly with experimental values of the multiplet splittings for a few cases.
Niche models can be used to test hypotheses about how environments have shaped species distributions over evolutionary time and to project potential responses to changing climate. Rhododendrons are an excellent model system for such work because they are widely studied due to their horticultural uses, and considerable distribution data exists for numerous species in this genus. Specifically, Rhododendron viscosum is a North American species with 388 locations in the native range in GBIF. Also, a methods note: We used location data from the Global Biodiversity Information Facility (GBIF), a publically available database, to gather known location data from around the world. We manually removed locations that were located outside the native range, so that we could develop a niche model for climate tolerances to the native range. The completed model can be applied to map many species of Rhododendrons and attempt to understand the impact of climate change. The model was then applied to current and past environmental conditions to compare the effects of climate change. Thus far, there is not a species distribution model that spans all species of Rhododendron to predict where they can and likely will grow in addition to the lack of climate change impacts on the elevations where all these species grow. A few iterations of the model were run to determine the best way to define the geographic domain and environmental background for the model. Once we determined which would be best we completed the model for the single chosen species. We will use predicted future climate envelopes, based on projections of climate change, to predict potential future distributions of Rhododendron species. This work will have implications for identifying potentially vulnerable species. Species that are currently common could become vulnerable in the future, especially if they have a narrow range of temperature or precipitation tolerances.
Radio frequency (RF) power measurements are important for many applications including radar, telecommunications and material processing. One method for accurately measuring RF power is calorimetric DC substitution, which compares the heating of a load from applied RF power to the heating caused when a DC voltage is applied across the load. Bird Technologies has developed a microfluidic substitution based device. I have developed the firmware and digital feedback control system for the device and give details about the design and performance of the firmware and controller.
Whegs series robots are biologically inspired machines that utilize a method of locomotion that combines the relatively simple design of the wheel with the obstacle-clearing advantages of the leg (wheel-legs). Current Whegs can traverse varying terrain and have shown stair climbing capabilities. However, current Whegs create a jarring motion when climbing multiple stairs, lowering the “climbing efficiency” (power usage for productive forward motion). Dr. Richard Bachmann's “zipper mast” technology holds promise for improving this efficiency. A zipper mast is a telescoping linear actuator with three coiled strips of material that band together to form a rigid mast. This technology has a compact form that has the capability of increasing a robot's effective length with which it can extend over an obstacle. The immediate objective of this project was to design, build, and test a new Whegs prototype that utilized the compact design of the masts to prove the functionality within the Whegs robot series. The extendable masts, which allow for the center of gravity of the robot to be shifted forward, prevent the unwanted backward motion that had posed problems for previous Whegs.

We are employing recent advances in zipper mast technology to create a Whegs robot, which takes advantage of the compact design to enable efficient stair climbing and improve steering capabilities. The design incorporates two separate sections of the chassis that connect via two mast units. Using two units allows for the prototype to extend up to 7 inches in length, which improves the prototype’s ability to use more power for forward productive motion, increasing climbing efficiency. The prototype has the ability to climb over multiple stairs between the heights of 8 and 10 inches as in accordance with nominal stair heights. Additionally, the two masts can be controlled independently to allow for simultaneous extension and compression, adding steering capabilities.
Pretend play is important for children’s social, emotional, and cognitive development. Previous research has demonstrated that children with Prader-Willi Syndrome (PWS) have impaired pretend play abilities, however, it isn’t clear what type of difficulties they have. The purpose of this study is to learn if typical children are more likely to diverge from a given theme in pretend play than children with PWS. Children that diverge from a given theme create and play with storylines other than the storyline presented to them. This ability reveals divergent thinking skills in children which is a key component in creative problem solving.

19 typically developing children and 19 children with PWS, ages three to five, were administered the Affect in Play Scale-Preschool version. Videos of these sessions were coded for duration of play in the original theme, duration of play in divergent themes, and a frequency count of the amount of divergent themes a child played through. Comparisons between groups on the duration and frequency counts of original and divergent themes in typical children and children with PWS will be discussed. The information gained from this study can help expand the understanding and characterizations of pretend play in typical children and children with PWS, and it can help create further interventions with play.
Coffee is a 40 billion dollar industry in the United States, with over 100 million Americans drinking it every day. As more local roasteries are established, the science behind coffee roasting has been researched further. Many variables, from roasting times to temperature, have been tested and perfected to improve the taste of coffee. Perhaps one of the most important factors influencing taste is the proper collection of “chaff” from the roasted coffee beans. Chaff is the thin skin of coffee beans that breaks off during roasting. Chaff does not improve coffee taste and must be removed during the roasting process. Many coffee roasting processes have relied on the use of cyclones to help in the collection of chaff. Without an efficient cyclone, chaff collection can be a challenge. In this study, the cyclone collection system at Rising Star Coffee Roasters was analyzed for efficiency. Using traditional design methods and cost analysis, an affordable optimized cyclone design was constructed for the system at Rising Star. From this design process, a method for designing future cyclones for other coffee roasters was created to streamline the process.
Semantic satiation is the phenomenon whereby the meaning of a word is temporarily “lost” or obscured following exposure to prolonged repetition of that word. This phenomenon is well-attested in purely verbal domains: hearing or saying aloud a word a large number of times produces definitive and clearly observable satiation effects, which can be measured via the time it takes to judge whether or not another word is related to the original, repeated (i.e. target) word. However, semantic satiation has not yet been investigated in a “physical” domain.

This study therefore examined the extent to which semantic satiation occurs in the physical domain, and how it compares to verbal semantic satiation. All participants viewed target action words (e.g. “snap”) repeated either 3 or 30 times, before judging which of a new pair of words (e.g. “jog,” “flick”) was related to the target word. Participants in the verbal condition read aloud the target action words and verbally indicated their relatedness judgment. Participants in the physical condition performed the target action words and physically indicated, by performing the word, their relatedness judgment. We expect longer relatedness judgment times in both domains following longer (vs. shorter) repetition of target words.
The purpose of this project is to debunk the myth that dreams have symbolic meaning, and to discuss the main brain functions that produce the phenomenon of dreaming. Dream interpretation dates back to ancient societies where it was used to communicate with divine beings, and has since developed into a technique used by some psychotherapists. Dream analysts claim to interpret symbolic meanings of dreams, but the legitimacy behind this interpretation is misleading. My project will review how self-conscious awareness is lost in sleep thus making it impossible to recall every detail of a dream. In order to accurately interpret a dream the dreamer must explain their dream thoroughly, but executive functions of the brain such as self-observation and decision making abilities are lost in sleep hindering the dreamer from having any control over the content of their dreams, or accurately recalling them. The findings of this project will ease the minds of those who feel obligated to place a meaning upon our meaningless dreams.
Abstract

Environments where there are many talkers speaking are often hard for listeners. This is due to auditory masking: the reduction of a listener’s ability to understand a target talker when there are other people talking in the background. It has been shown that meaningful-background speech causes greater masking compared to semantically anomalous-background speech when trying to understand meaningful target sentences (Brouwer et al., 2012). However, when this result was observed the methods used did not control for differences in rhythm between the meaningful and anomalous stimuli. It is unknown if this rhythm in the background speech could impact the listener’s ability to understand target speech. In the current experiment, we controlled for both rhythm and meaning of the background speech to determine if both meaning and rhythm are responsible for differences in a listener’s ability to understand target speech in a noisy environment. Two phases of the experiment were conducted. The first phase tested listener’s ability to understand meaningful target sentences over multiple masking conditions and the second tested a listener’s ability to understand both meaningful and anomalous target speech over multiple masking conditions. We were unable to replicate the results found in Brouwer et al. (2012). Our results indicate that the meaningfulness of the competing speech did not change masker effectiveness, nor did changes in rhythm due to simple syntax differences within the competing speech.
The inquiry into creativity had been limited until 1950. As the research about creativity has become popular, a debate on the relationship between creativity and mood disorders has arisen in the field of psychology. On the one hand, some psychologists and psychiatrists, based on biographies of some exceptional artists, believed that a relationship between mood disorders and creativity exists, but they could not prove it scientifically. On the other hand, many others argued that without any empirical proof, it would be merely a popular myth that draws the public’s attention rather than a vigorous scientific study. This project delves into the debate in psychology and verifies whether the relationship between artistic creativity and mood disorders is merely a pop psychology or a scientific correlation. It concentrates on bipolar I disorder, which is believed by psychologists to be strongly associated with artistic creativity. Furthermore, studying the relationship between the two will help creativity psychologists and neuroscientists to comprehend the complex structures and functionality of our brains regarding creativity. Accordingly, verifying the relationship between the two will let the public have accurate information about creativity.
Rewards can serve as positive reinforcements to encourage certain behavior was once the most well-known finding in the field of behavioral psychology. The finding is based on principles of operant conditioning and seems intuitively correct. However, the accuracy and validity of this theory has been questioned and tested in the past few decades and a considerable amount of evidence shows that rewards might not necessarily reinforce a behavior. Instead, rewards can actually discourage an individual’s motivation to engage in a task that could have been done with more passion and autonomy. The phenomenon is called over-justification effect, an effect that occurs when an individual’s intrinsic motivation is undermined by external rewards such as a monetary prize. This project introduces the concept of over-justification and gathers information from different studies and researches that yield similar results against the old theory of operant conditioning. The project also summarizes how the over-justification effect may or may not happen according to features of rewards, purposes of rewards, and characteristics of recipients, etc. Lastly, the project offers some insights on how the over-justification effect could be applied to different kinds of realistic settings such as educational setting and business setting.
Stirring in solid contents to a liquid base can be a slightly time-consuming and tedious task. Therefore, a revolutionary nitinol-based stir rod has been researched and designed to help eliminate this cumbersome task. The nitinol-base stir rod has been designed on a thermally insulated rod to be used primarily in the stirring of hot beverages. CES Edupak was utilized for quantitative material analysis of the rod. The idea is that the shape-memory effect found in nitinol springs may be utilized to propel a rotational disc in a heated beverage that would then be able to mix its contents more effectively than a simple rod or kinetic diffusion (i.e. sugar in tea). It is also possible to tune the composition of the alloy so that the transformation temperature is less than room temperature for mixing of cold beverages such as chocolate milk. This device will require no electricity but still be able to mix the beverage on its own utilizing the shape-memory effect.
### Abstract

The psychological myth that it is more beneficial for students to stick with their initial answer on a multiple choice test still prevails despite contradictory evidence. This poster compiled information from multiple studies and focused on the truth value of this claim in order to help students in test-taking strategies. It was found that when a student is doubtful of an answer, it is often more beneficial to change their multiple-choice response than to keep their original response, with consistently over half of students benefitting from this practice. Though presenting this information alone for students has not proven to change their test-taking behaviors due to an ingrained belief in the myth at this time, more of an emphasis needs to be placed on these findings moving forward. With an increased awareness of the truth value of these findings, individuals will be able to use this advice to improve their test scores and overall performance as students.
Mini-Whegs™ is a small mobile robot capable of navigating difficult terrain. These robots use an appendage called a wheel-leg, which is essentially a rimless wheel. Wheel-legs combine the speed and ease of control of a wheel with the climbing mobility of legs. The primary objective is to build a 3D printed Mini-Whegs™ with autonomous navigation. The motivation for this project is to create an exciting and interactive demonstration tool to show prospective students the type of projects they could be involved in as undergraduate students at Case Western Reserve University. The robot could also be used to interest K-12 students in STEM fields.

Progressing from a previous Mini-Whegs™ design with Bluetooth control, this new design will use Arduino IDE software programming to travel autonomously along a wall using its antenna sensors and digital compass, adjusting its direction as it meets the wall and climbs over obstacles. In addition, the new design has a greater climbing capability due to one inch larger diameter wheel-legs and a larger 850mAh battery. Lengthening the chassis by two inches and widening it by one inch provided room for the additional sensors and a relocation of the Arduino into the chassis of the robot. These alterations resulted in a combined chassis and lid height reduction of half an inch. During test-drive exercises the previous version experienced motor stalling when moving forward and turning at extreme angles. Inconsistent turning due to steering slip between the wheel and axle was also observed. To decrease slip in the steering the slot profile in the 3D printed ball sockets connecting the wheel-legs to the drive shaft was modified. The majority of all improvements were to the 3D printed parts, thus making the Mini-Whegs™ an easily recreated kit to be used as a demonstration tool. Validation of design concept will be shown in a fully built autonomous Mini-Whegs™.
Following molecular changes in Escherichia coli biofilm formation using Raman spectroscopy

Biofilms are a ubiquitous form of life for bacteria and fungi, and have profound impacts on human and veterinary medicine. Acting as strongholds against antimicrobial agents and environmental stresses, biofilms confer resilience to infections and promote lingering disease. Assessing the molecular changes associated with biofilm formation, metabolism, and dissemination are therefore of critical importance. Raman spectroscopy may be used to obtain high-quality, highly detailed spectra from near-real-time sampling and track changes between the planktonic and biofilm states, providing a foundation for a wide variety of future studies. Using Escherichia coli as a model organism, these methods demonstrate the viability of such an approach.
Interest in polymer brushes in recent years has shifted from synthesis and properties towards practical applications. Due to advances in polymerization techniques, the field of polymer brush synthesis has expanded multiple times over. These new techniques allow a variety of nanoparticles, as well as surfaces to serve as the substrate for many different kinds of polymers to be grafted onto. The variety of polymers allows for the creation of brushes with specific properties. In this project, poly-tert Butyl Acrylate is synthesized onto silicon surface. These wafers are then characterized, and converted to poly-acrylic Acid (PAA). PAA exhibits a sensitivity to ion concentration, and depending on the pH, the brushes will either expand or contract. These PAA brushes on silicon wafers act as a model for a cell membrane. Modern anesthetic, such as lidocaine and tetracaine can be introduced into the polymer brush environment, and the interaction between these two will provide novel data on how anesthetics interact with cell membranes inside the body. The wide variety of molecular features these brushes exhibit make them a fascinating topic in modern day macromolecular science.
Abstract

The purpose of this project is to develop an in-box Thermal Gradient application for the Keithley Digital Multimeter as a proof of concept for later similar device applications. The need for this project arise from latest generation of Keithley multimeters incorporate touch-screen design that allows more customizability. The thermal gradient application utilizes inverse distance interpolation to provide visualization of temperature gradient on a 2-D surface. This application demonstrates that the processing unit of current Keithley digital multimeters are capable of providing the computation powered needed for similar graphic related algorithms.
Beginning in June of 2017 and ending in December of 2017, I was a cooperative education intern at Philips Healthcare in Highland Heights. I was employed in the CIRS subsystem (Common Image Reconstruction Subsystem) as a hardware co-op. This role entailed the maintenance and development of new hardware systems in order to support the efforts of the software development team. During my employment I engaged in documentation, testing, hardware prototyping, hardware troubleshooting, and technical information collection. I will be presenting on my overall experience during my co-op as well as on the major projects I was engaged in. The two major projects I was involved in were bringing and maintaining a server closet to FDA compliance and failure rate analysis of different hard drives in use by customers. Both of these projects were successfully completed following my co-op and I will discuss the major challenges and results of my work. Finally, I will highlight the technical skills I developed during my employment as well as other non-technical skills I have developed. This is in accordance with the lesson plan for EECS 398 taught by Dr. Gregory Lee.
Abstract

Prospero is a web application that automates the tedious, algorithmic parts of a theater stage manager’s job, allowing the stage manager to focus on the needs of the people in the room. The application calculates the best rehearsal schedule based on actors’ availability and the director’s needs, and allows the stage manager to efficiently communicate versioned, updated schedules and rehearsal reports each night with minimal effort. The most important aspects of such a system are the abilities to quickly input actors’ and staff's needs, generate a schedule that meets as many of these needs as possible, lay out reports each night based on this schedule, and change the schedule as needed if unforeseen problems come up during rehearsal. Accordingly, Prospero has been designed by and for stage managers with ease and speed of use in mind. Performing arts software combining easy data entry and rapid schedule generation and analysis does not currently exist. An additional reach goal of the project is to create a companion mobile application for actors to check into rehearsal each night and view their upcoming schedule.
Moisture content (MC) has many effects that play a part in the pyrolysis of fuels through changes in ignition time, thermal properties, mechanical properties and burning behavior. This project explores the different effects MC can have on the flammability of woody materials and provides a mathematical pyrolysis model to account for MC in burning cellulose. The mathematical model chosen is a global reaction scheme which uses seven single-step Arrhenius equations to capture the complex interactions of the competing or consecutive chemical reactions involved in the pyrolysis of cellulose. This project will take this model and integrate it with the a transient combustion code from the Computational Fire Dynamics Lab which simulates the ignition, transient flame growth, and steady state flame conditions of solid materials. The updated code will be validated against experimental data to ensure the changes in the code properly capture the appropriate MC effects, especially those during the ignition of cellulose, such as delayed ignition time, critical heat flux, and ignition temperature.
My research project focused on odor learning in the moth Manduca sexta and its implications for how M. sexta tracks odor in flight. When wind disperses odor molecules that are evaporating from a source, an odor plume is formed. While the behavior M. sexta exhibits while tracking an odor plume is known, the mechanism that they use to track the odor is still unknown. M. sexta exhibit a zigzagging pattern known as “casting” while tracking an odor, but it is unknown what influences how they steer to maintain contact with the odor plume. Recent results suggest that M. sexta males may use the distribution of the odor in space to control their steering to maintain contact with the odor plume. By testing M. sexta's ability to discriminate between odor applied to their left or right antenna, we can determine whether or not they are able to use a bilateral comparison of odor intensity between their two antennae to steer their flight toward an odor source. We tested this hypothesis by using operant conditioning to facilitate odor learning using two different floral odors, linalool and benzaldehyde. Individuals were conditioned to associate an odor stimulus on one antenna, either left or right, with a sucrose reward. Electrophysical recordings of the muscle activation patterns associated with feeding movements were used to determine whether or not odor learning had occurred. Results from these trials show that M. sexta is indeed able to associate odor stimuli on a conditioned antenna with a sucrose reward for both linalool and benzaldehyde. This indicates that M. sexta has the ability to discriminate between encountering odor on their left versus right antenna. Further research must be done to determine whether M. sexta uses this information to track odor plumes.
Friction stir welding (FSW) is a process where material is welded by a rapidly-rotating steel pin extending from a cylindrical shoulder. Frictional heating from the rotation of the shoulder against the material being welded allows it to be deform the material being welded. During this process, precipitates in the material are broken up and reformed under the heat caused by the friction in the heat affected zone under the shoulder of the welder.

The purpose of this project is to model Friction Stir Welding (FSW) precipitates and formation inside and near the heat affected zone (HAZ). This study will focus on aluminum alloys both 1000 series pure aluminum alloys, 5000 series aluminum with magnesium, and 6000 series aluminum with magnesium and silicon alloys with various heat treatments. The accuracy of the modeling between the different alloys will be compared to each other. This modeling effort consists a heat transfer model to describe the temperature of the weld as a function of time and a precipitate model to describe the formation of precipitates in the HAZ. The heat transfer model will utilize material properties from CES EduPack to determine the heat conducted away from the friction stirring mechanism. The precipitate modeling will be performed in PRISMA which will determine the average precipitate size and distribution in the weld of the material. Once the particle distribution in the weld is known, that information can be used to understand the strength of the welded material. This can be compared to the strength of the un-welded material. This project will help to understand the mechanical properties of FSW materials computationally before testing physical samples.
The purpose of my project is to design a Jumping Mini-Wheg™ that can jump over objects that are at least 15 cm tall. The jumping mechanism will be easily able to reset and will not cause the Mini-Wheg™ to flip over and land on its back. Previous designs of a Jumping Mini-Wheg™ used a 4-bar mechanism that mimics a frog jumping. While it was successful at propelling the Mini-Wheg™ over large obstacles, it lead to the robot flipping uncontrollably in the air and often times landing on its back. This requires that the robot is designed to operate flipped over. Requirements for ground clearance on both sides can limit the equipment that can be attached to such a small robot. This project seeks to design a jumping mechanism that does not require the robot to be designed with such limitations by not flipping over the robot.

The jumping mechanism that is being designed is a spring powered launcher that is positioned on the back of the Mini-Wheg™. There is a secondary mechanism that props the Mini-Wheg™ up to a specified angle. Then the spring powered mechanism will launch the robot at the angle it is propped at. Since the mechanism is close to the center of mass of the robot, very little rotation should occur. Once the Mini-Wheg™ lands, the spring will be compressed by the jumping motor and ready to be reused. The spring release mechanism is a choo choo mechanism and the propping mechanism will support the Mini-Wheg™ from the front. The spring that will launch the robot over the obstacle will be determined by the amount of energy needed to overcome gravity to achieve the height of 15 cm. Once that is determined, it is known how much force is applied by the spring. This can be used to determine how much the robot will rotate in the air in order to prove that it will not flip over. With this determined, the mechanism will be modeled in Solidworks. The final design will be used by a future group to create a jumping Mini-Wheg™ that will successfully jump without flipping.
Forensic Anthropology and the Problematic Use of the Race Concept

Eddie Villarreal, Department of Anthropology

Age and Sex are two key features used by Forensic anthropologists in the identification of human remains. Along with these two features, racial identification is also commonly used in creating a profile for human remains, but unlike age and sex this method is much more heavily contested. Race as a concept has been a heavily debated topic for some time due to the homogeneity it attempts to establish to justify its categories, like Asian and Hispanic, which lies in direct contrast with the highly diverse populations within them. For Forensic anthropologists, this debate is also relevant in their work because in attempting to use racial identification in their work many researchers have attempted to establish a record of static physical characteristics commonly observed in specific racial groups. However, the viability of this method has been called into question, especially by other Forensic anthropologists, primarily because in attempting to establish these static characteristics observed among all members of a racial group the large extent of physical variation also observed within these groups is often put aside. For example, one study by Cris E. Hughes in 2013 looking at the cranial morphology variation in Mexico found that the regional variation between individuals from the north, central, and southern parts of the country was significant enough to separate them into different groups. A relevant finding considering that this variation observed among Mexicans only represents one population under the Hispanic category. This presentation analyzes how research on racial identification within the field of forensic anthropology recognizes the faulty nature of this method and the use of the race concept as well as the reason why despite all this many researchers still find racial identification useful.

Project Mentor: Cynthia Beall, Department of Anthropology
The presence of subliminal messages in different media outlets has been a concern for many people because it is believed that the strong effects of subliminal messages in advertisements, music, and even movies influence people to spend money on things, or do things they may not need nor want to do. While there is some merit in this statement, research shows it is not entirely true. For example, research has shown that subliminally priming a specific brand name beverage does influence participant’s choice of drink, but this was only shown to be effective when the participant was already thirsty. In other words, subliminal priming is only effective when the consumer already has the motivation to achieve the goal of quenching their thirst or acquiring the product being presented. These and other findings disprove the notion that we are easily manipulated into buying or doing things we are unaware of at the conscious level, and how we as consumers are affected by the media.
The Zika virus (ZIKV) has captured worldwide attention with the ongoing epidemic in South America and its link to severe birth defects, most notably microcephaly. ZIKV is spread to humans through a combination of vector and sexual transmission, but the relative contribution of these transmission routes to the overall epidemic remains largely unknown. Furthermore, a disparity in the reported number of infections between males and females has been observed. We develop a mathematical model that describes the transmission dynamics of ZIKV to determine the processes driving the observed epidemic patterns. Our model reveals a 4.8% contribution of sexual transmission to the basic reproductive number, $R_0$. This contribution is too minor to independently sustain an outbreak but suggests that vector transmission is the main driver of the ongoing epidemic. We also find a minor, yet statistically significant, difference in the mean number of cases in males and females, both at the peak of the epidemic and at equilibrium. While this suggests an intrinsic disparity between males and females, the differences do not account for the vastly greater number of reported cases for females, indicative of a large reporting bias. In addition, we identify conditions under which sexual transmission may play a key role in sparking an epidemic, including temperate areas where ZIKV mosquito vectors are less prevalent.
Abstract

There have been many attempts to create games centered on the theory of evolution. The purpose of these games range from recreational to educational. However, there is a universal failing to balance the game mechanics with an accurate depiction of evolution. Evolution-based games are often either wildly inaccurate, as population’s features are selected by the player and not by the population’s environment, or are barely games at all. In this project, we attempt to rectify this problem by designing a game based in evolutionary theory that is both accurate and entertaining. This game, titled Homimania: Out of Africa, strives to educate the player about the mechanisms of evolutions as well as the rise of the genus Homo. The mechanics of Homimania are similar to popular turn-based strategy games, where players control the migration and low of their populations to spread and ‘conquer’ as much as the map as possible. Unlike other evolution-based games, the player does not get to design traits to give themselves an advantaged; rather, simulated evolutionary mechanisms will determine the player’s success. Thus, Homimania will serve as an educational tool to teach players about evolutionary theory and human pre-history, while still functioning as a game.
Consider a group of robots in a search and rescue mission. If a robot fails, how should the team adapt to continue the mission? My work investigates approaches to dynamically adapt the existing multi-agent policy without expensive interactions with the environment, so the new team can start with a policy better than several baselines.
An ornithopter is an aircraft that uses wings to generate lift and thrust, with designs often based around animals in nature. The CWRU Biorobotics lab has been doing research into one such ornithopter, with its design template being based off the physical characteristics of the Hornworm moth (Manduca sexta). In order to properly replicate the insect’s method of achieving flight, it is imperative that ornithopter have the ability to control each wing individually, in order to generate lift and control the direction of flight. However, trying to create a working moth-sized ornithopter presents its own unique set of challenges, as the current limits of manufacturing technologies and available retail components often force these designs to remain relatively simplistic in scope. This in turn makes it difficult to integrate into the design any components that can create the necessary asymmetric wing control. The goal of this project is to design the architecture for one such ornithopter that can asymmetrically control its wings while still being the same size as the actual moth (defined as 1”x0.5”x0.5”). In this new architecture, the wings are split up into their own separate sub-systems, so as to allow the controller to control them both individually. Within each subsystem, the wing-flapping motion is driven by an electric actuator attached to a scotch-yoke mechanism, allowing speed of each wing to be controlled individually, while a linear actuator attached to the motor crank allows the wing-flapping amplitude to be adjusted. In order for the controller to determine how much it should adjust the linear actuator by, a mathematical model has been developed that describes how the wing-flapping amplitude is affected by the changes to the geometry of the wing-mechanism. The motors and actuators are taken from the smallest available retail components, with the frame designed to fit around them.
GeoCivics is a platform for comparing Open Data over shared locations. The GeoCivics team aims to make adding new data and consuming normalized data effortless for researchers.

Abstract

A wealth of civic data exists on the web across a variety of sources and formats. Location is common to nearly all of these data sets. Thus, it should be possible to leverage this common feature to gain access to broader insights across otherwise disparate data sets. The GeoCivics team is building data infrastructure to consume location-based civic data, normalize the data around location, and provide an intuitive user interface to access the data. This will allow users to contextualize data in terms of location as well as in terms of other data available for a given location. A wealth of civic data exists on the web across a variety of sources and formats. Location is common to nearly all of these data sets. Thus, it should be possible to leverage this common feature to gain access to broader insights across otherwise disparate data sets. The GeoCivics team is building data infrastructure to consume location-based civic data, normalize the data around location, and provide an intuitive user interface to access the data. This will allow users to contextualize data in terms of location as well as in terms of other data available for a given location.
Robust industrial networks exhibit fast fault recovery times, connection redundancy, and electromagnetic noise immunity. Validating this robustness requires a reliable method for breaking and establishing ethernet connections on the physical layer level. The design approach for this need was centered around a gigabit ethernet multiplexer. The multiplexers provide fast on-off times and preferable bandwidth, crosstalk, and on-resistance characteristics. Additionally, fully utilized ethernet multiplexers can be used to dynamically reroute physical ethernet connections and modify network topologies. This presentation will cover the design and implementation of non-isolated and isolated multi-node gigabit ethernet multiplexers.
Carbon nanotubes are emerging as a viable material for reinforcing polycarbonate composites due to their excellent mechanical properties such as high specific strength, tensile strength, hardness and Young’s modulus. The applications for carbon nanotube reinforced composites span many industries though the focus of this research is for fabricating composites for wind turbine blades. The most significant challenge of fabricating composites is sufficient load transfer. The lack of ample load transfer is due to the hydrophobicity of the carbon nanotubes. One way to combat hydrophobicity is a process called plasma functionalization. Plasma functionalization uses oxygen plasma to add oxygen containing functional groups to the surface of carbon nanotubes by disrupting the bonds at the surface. One way to measure the effect of plasma functionalization is through contact angle measurements. Contact angles, the angles that form between a drop of testing liquid and the surface that is being tested, are used to quantify the properties of the solid surface. The contact angles of the plasma treated polycarbonate and buckypaper were smaller than those of the untreated samples. This shows that plasma functionalization reduces the contact angle of water, dimethyl sulfoxide, and epoxy. This reduction in contact angle correlates with an increase in wettability and a possible increase in adhesion. An increase in adhesion will make the composites stronger. Future research would include gathering contact angle data with other testing liquids so that the surface energy could be estimated. It would also include fabricating composites with plasma functionalized carbon nanotubes and experimentally testing their strengths.
Fetal alcohol syndrome, one of the leading causes of birth defects in the United States; however, limited research has been done regarding the effects of alcohol on early development. This project uses optical coherence tomography (OCT) to study ethanol-induced alterations in brain and heart vasculature of quail embryos.

Fetal alcohol syndrome, one of the leading causes of birth defects, encompasses a collection of developmental abnormalities that results from a mother’s consumption of alcohol during pregnancy. The central nervous system, in particular, is vulnerable to alcohol exposure during prenatal development. Due to their relatively short gestation period and similar heart development as that of humans, ethanol-injected quail embryos were used as a model to further investigate the underlying causes of congenital heart and central nervous system defects that result from exposure to a binge-like quantity of ethanol. Here, we explore the survival rate and the observable physical differences in ethanol-treated quail embryos. Also, we employ an imaging technique called optical coherence tomography (OCT) to study cardiac defects, particularly, to identify any changes in vasculature in the fetal heart and brain that result from ethanol exposure during gastrulation. By understanding the underlying consequences that result during fetal development after exposure to ethanol, it is possible to develop and test treatments that may impede or cease the detrimental consequences of fetal alcohol syndrome.
Intracortical microelectrodes are devices implanted in the brain that can record the electrical signals sent between neurons. While the potential for this technology is significant and far-reaching, these electrodes often fail to function long-term. A primary reason for this failure is the immune response of the brain to the foreign object, which causes neurons near the electrode to die off, rendering the device unusable. In an attempt to mitigate this process, researchers at the Capadona Lab at Case Western Reserve University tested two variables in mice with implanted electrodes; the effects of the variables on the neuronal density of the brain tissue around the electrode were then observed. The variables analyzed were (1) the presence of the cd14 gene, which codes for the receptor protein CD14, a molecule involved in activating immune response, and (2) the electrode’s stiffness—specifically, comparing a stiff silicon electrode and a softer shape-memory polymer (SMP) electrode. Four groups of mice, for each combination of variables, were set up. Two weeks after electrode implantation, the mice were sacrificed, and pictures of their brains were prepared for analysis. I then looked through the pictures, selecting neurons using computer programs designed by the lab. The data obtained were analyzed in MATLAB and Microsoft Excel. It was found that both groups of cd14 knockout mice did not have significantly different neuronal densities from the control; however, close to the electrode, knockout mice with SMP electrodes had significantly lower neuronal density than those with silicon shank electrodes. The findings suggest that CD14 does not play a key role in the brain’s immune response and that there is not a large difference between SMP and silicon shank electrodes’ biocompatibility.
Fossil remains contain a wealth of information; yet various methods of extracting this information can result in conflicting and confusing results. One of the most challenging problems in paleoanthropology that can result from these potentially confusing results is the taxonomic classification of hominid species. Recently, newer computer-based methods of analyzing fossil anatomy, such as geometric morphometrics, have been rising in popularity due to their quantitative results and promise for revealing new information. However, geometric morphometrics and the current common methods used in the paleoanthropology field lack some of the most interesting and innovative data analysis methods found in other fields, such as computer science. This project will explore the potential application of machine learning, a subfield of computer science, in analyzing this problem. In particular, this project attempted to evaluate the efficiency of using support vector machines (SVM), trained on histogram of gradient features (HOG) and speeded up robust features (SURF), to classify images of extant ape distal humeri. Overall, the SVMs were successful at classifying the images, particularly those trained on HOG features. This shows the potential for machine learning to very accurately classify extant ape specimens, which can then be used to analyze hominin fossils.
The Thermal Protective Performance (TPP) rating of a material is a value indicating the approximate time it takes a standardized amount of heat flux (ASTM D 4109, 1982) to penetrate through a material and cause second degree burns to the skin. A material’s thickness and physical properties are the dominant factors behind its TPP rating. Naturally, a higher TPP rating is desirable when seeking more thermal protection and so, research pertaining towards discovering and developing low-cost and lightweight fabrics with high TPP ratings has relevance in industries such as fire-fighting, which frequently deal with environments where both radiative and convective heat are present in high amounts. The research done by this group focused on measuring various materials to determine a fabric that has thermal insulation properties suitable for sufficiently delaying second degree burns while minimizing density of the fabric so that it can ultimately protect an individual against high heat flux exposure while being lightweight enough to not drastically hinder their movements. The TPP rating is determined by using the Govmark TPP-2 apparatus for fabrics; it is equipped with a 40 mm-diameter copper calorimeter, a Meker burner, air and propane mass fuel controllers, and a data acquisition system for collecting heat flux data. A test material placed in between the calorimeter and the burner’s flame; the transducer above the fabric measures the heat absorbed by the fabric over time and then compared to the Stoll Curve. The intersection between the two graphs is the length of time that the test fabric can delay a second-degree burn from occurring; the TPP rating given to the fabric is the time multiplied by the heat flux applied. The trials documented in this report determined that [Fabric X] has the optimal fire combative properties with an average TPP rating of [XX], with a variance of [XX], and a density of [XX].
**Abstract**

Agreeing on what movie to watch with friends is a lengthy, often heated process. Even deciding what to watch for yourself can be overwhelming. Current recommendation systems for media are focused around the individual, and the selection is limited by the content provider supplying the recommendations. Reeltalk is a service that will recommend movies and tv shows for groups. Reeltalk is a website and an app that allows users to easily get media recommendations for watching movies or tv shows with their friends.
Abstract

The physical interactions between solid surfaces affect many occurrences in daily life. These interactions are also seen in a variety of industrial applications such as material processing. When these interactions take place, attractive and repulsive forces arise. These adhesive forces are categorized as Hydration forces, Electrostatic forces, and van der Waals forces. Industries such as the polymer engineering industry lack a fundamental understanding of the origins of polymer adhesion and how to manipulate the strength of the adhesive forces. To understand the interactions between similar blocks of polymer, the adhesive strength of lap-joints had been measured. The polymer being studied is synthesized from a combination of two surfactants and three monomers. To create the lap-joints, the solid polymers were contacted by aqueous salt solutions and once dried, the salt tended to enhance the adhesion between the solid polymers. In this work, the role of contacting the polymers with aqueous salt solutions was systematically studied. Aqueous solutions contained 11 different concentrations of CaCl2 and NaCl measured in weight percentages (wt.%) were applied to the polymer surfaces. The shear force was measured to provide insight on the role of the salt solution in promoting adhesion. This allows the conclusion to be drawn that the results are consistent with the hypothesis that the measured adhesive forces are associated with hydration forces within the deposited salt layer.
When humans become sick, we often seek assistance from a certified medical professional for counsel and relief. Often our view of medicine is shrouded in the biased belief that a person of any background can be treated in the same manner that we are accustomed to in our modern western civilization, producing similar outcomes. However, there are important and unique challenges that distinct outcomes, socioeconomic backgrounds, and infrastructure can play in the transmission, treatment, and stigma associated with specific diseases. This project seeks to analyze the cultural and socioeconomic impacts on disease transmission in Africa and assess how and why traditional African cultures assume the stigmas associated with certain diseases and how these factors can influence said treatment and outcomes. I will outline the basic central African infrastructure issues and cultural practices often used to treat and mitigate disease. I will then focus on a case study of depression to illustrate the effect of stigma on disease transmission and treatment created from unique African cultural challenges. This study is part of a growing body of research developing methods in order to cope with cultural challenges presented in the face of mental health awareness.
Inventarium is an iOS and Android shopping list application that aims to fix the shopping experience for our users. Often people rely on written or mental shopping lists; however, they often find that they have forgotten items once they return from a shopping trip. The current system fails to inform users of what they are missing and what they already have in their pantries. Rather than simply replicating the pen and paper shopping list, Inventarium incorporates a two list system: one that contains what is in the user’s pantry and one that contains items the user needs to purchase. The two lists will work together dynamically, building off one another to create a bridge between the lists. As users make purchases and consume items, they can move items back and forth between these two lists so that they always know what they have and what they need.

Inventarium allows users to easily add items using image recognition, barcode scanning, voice recognition, chatbot and text input. Once lists are populated with what the users wishes to purchase and what the user currently owns, the user can then begin to move items between the two lists -- users no longer need to re-input items. For example a user who wants to purchase cereal can input his choice of cereal through one of the given inputs. Once the user has purchased the item, the item will be transferred to the pantry list. When the user runs out of the item the user can transfer the item to the shopping list creating a cycle that eliminates repetitive input of items. Inventarium will also provide direct shopping links to Amazon so that users can buy items directly.

Inventarium will also allow the lists to be shared with users rather or not they have Inventarium installed. Inventarium is able to accomplish this by allowing the recipient of the shared lists to update either list using our intelligent SMS chatbot. Furthermore, Inventarium will provide insights on a user’s shopping and consumption behaviors.
Adenosine Triphosphate (ATP) is most well known for its biochemical role in intracellular energy transport. However, a less well known role that ATP plays is as a chelator for divalent ions. We have recently become interested in poly (acrylic acid) (PAA) gels as a model system for biomimicking physiological systems such as muscles and nerves. We have observed reversible shrinking and swelling of PAA electrospun fibers, mimicking properties of actin fibers in muscles, as a result of divalent/monovalent ion exchange. Our research focuses on the exchange of Na+ ions for Ca2+ ions in a PAA fiber system with single-aligned fibers that are 1µm in diameter. Using chelators similar to ATP, including Sodium TriPhosphate and EDTA, in a PAA fiber system we have produced contracting and expanding systems to mimic physiological behavior.
Estimating the Labor Market Value of Traditional Higher Education and Its Alternatives for Computer Occupations

This paper seeks to estimate the labor market value of alternatives to formal higher education and explore how their emergence has impacted the traditional higher education premium for computer occupations. To measure this impact I use regression analysis to estimate the associate, bachelor's, and advanced degree premiums by occupation group using data from the U.S. Census and the American Community Survey from 2010 to 2015. I also estimate the massive open online course and coding school premiums with data from the 2016 Stack Overflow Developer Survey. Having a computer related occupation is not found to affect the size of the associate or advanced degree premiums. However, the bachelor's degree premium for computer occupations has consistently been one of the smallest of all high-income occupation groups since 2010. Also, completing a massive open online course does not have a statistically significant effect on salary or employment. Coding school alumni have an estimated 8 percent higher salary on average than those who are completely self-taught. This is slightly higher than the B.S. degree in computer science premium of 7.5 percent. However, there are potential sources of upward bias for the coding school estimate and completing a coding school program has an insignificant effect on the likelihood of employment.

Alternative forms of education, like massive open online courses, are becoming increasingly popular. Considerable disruption of the higher education industry is possible if these substitutes can provide significant labor market value. The results of this research help in determining the potential impact of these new forms of education.
The sales and distribution of counterfeit medication has become a major factor in the health crises of the developing world. Currently, counterfeit detection requires rigorous chemical testing that compromises the viability of this medication. Through the use of Nuclear Quadrupole Resonance (NQR), intact prescription drugs can be authenticated and distributed to these patients on site without affecting the efficacy of these medicines. The sensitivity of NQR measurement can be improved by pre-polarizing the medication sample in a static magnetic field. We will design a support system and engineer and assemble a 0.5 to 0.7 T permanent Neodymium (NeFeB) magnet with an approximate magnetic field volume of 1” x 1” x 4”. This magnet will be used for the pre-polarization of pharmaceutical drug samples before quickly moving the samples to the NQR apparatus for authentication. It will be designed to produce an optimal magnetic field profile and uniformity. Several potential obstacles associated with this design are the large amount of force between magnetic components during assembly, structural support of the apparatus, and optimizing field strength and uniformity with a preferred field profile. As well as designing and installing the magnet for pre-polarization, studies of the motion from the pre-polarization magnet to NQR will be conducted to optimize the NQR signal strength. The development of this magnet will allow a strong and uniform magnetic field while maintaining portability and ease-of-use of the assembled device.
The latest Solar Energy Industries Association (SEIA) report has shown that 2016 was a record year for installed solar with 14.8 GW of photovoltaic (PV) capacity added to the grid. This is a 97% increase in total installed solar energy, which significantly contributed to the 42 GW now installed globally. As solar energy continues to be adopted at increasing rates, it is imperative that the solar industry understand how the modules installed today will perform over its operational lifetime. At the SDLE Research Center, we are employing the use of accelerated testing chambers to mimic the outdoor environmental conditions which installed modules will experience. Stepwise measurements through time can be taken of modules as they are exposed to gain insights into the temporal evolution of these systems. Using current-voltage (I-V) curve tracing, we have collected data on samples that span 5 manufacturer brands, 3 wafer materials, and 5 exposure conditions. From these curves, 8 key parameters were used for analysis, there are: maximum power (P-max), fill-factor (FF), open-circuit voltage (V-oc), short-circuit voltage (I-sc), maximum current (I-max), maximum voltage (V-max), series resistance (R-s) and shunt resistance (R-sh). Using these parameters we have used various statistical analysis techniques including semi-supervised network modeling and correlation matrices to identify the most influential factors on overall performance under particular environmental stressors.
Identifying Mechanisms of Resistance to Protein Phosphatase 2A (PP2A) Activation

Cancer is a disease involving abnormal cell growth that claims millions of lives across the world on an annual basis. This abnormal cell growth is highly due to an imbalance between proteins that drive cellular division, or oncogenes, and proteins that prevent it, or tumor suppressors. One of the tumor suppressors that is commonly inactive in cancer cells is protein phosphatase 2A (PP2A), which dephosphorylates several major oncogenic signaling cascades. Its inactivation results in sustainable activation of oncogenic RAS/MAPK/MEK/ERK and PI3K/AKT pathways. The Narla laboratory has developed a series of Small Molecules Activators of PP2A (SMAP) that downregulate the oncogenic pathways aforementioned by reactivating PP2A and hence, inducing tumor growth inhibition. Since mutations at the drug binding site is a common resistance mechanism to targeted therapy, it was hypothesized that mutating the SMAP binding sites on PP2A would desensitize the tumor to SMAP treatment and abrogate the anti-cancer effect of the SMAPs.

After identifying K194, E197, and L198 as the putative binding amino acids of SMAP on the PP2A-A? subunit, those amino acids were mutated and introduced into the lung adenocarcinoma H358 cell line. The H358 isogenic cell lines with the different mutations were injected into mice and treated with either vehicle control, or DT-061, a SMAP derivative. It was observed that tumors harboring K194R and L198V mutations were resistant to SMAP treatment. These results suggest that SMAP binds at residues K194 and L198 of PP2A.
The marine mollusk sea slug Aplysia californica’s feeding behavior has been extensively studied by looking at activities of multiple interneurons and motor neurons within the buccal ganglion using traditional extracellular recording techniques on buccal nerves and muscles during feeding-like motor patterns in Aplysia. We are developing an experimental technique to investigate how individual identified interneurons and motor neurons contribute to neural networks of feeding-like motor patterns as both single units and as an entire population. By using a two-dimensional, high-density microelectrode array, we are able to simultaneously record many neurons projecting on different nerves within the buccal ganglion. Combining the array-recordings with the extracellular recordings of buccal nerves and muscles, we can identify some key motor neurons and monitor their activities during feeding-like patterns. We can also stimulate these identified neurons locally using individual array elements to explore how they interact with each other and affect feeding behaviors. We will incorporate current density analysis, spike-sorting algorithms to provide for the first time a more complete dynamics of a feeding pattern-generating circuit in Aplysia californica.
The introduction of expedient and fiscally reasonable genetic screening into clinical medicine has resulted in unparalleled progress in diagnostic medicine and personalized care. With this progress has come enhanced personal ownership of health outcomes and biological identity, which has been made evident through publicly available genetic testing for ethnicity and ancestry. Despite the apparent benefits, there are legitimate concerns about inaccuracies in genetic testing for genealogy, and increased need for addressing scientific illiteracy. Other ethical issues surround privacy of genetic data and a new definition of personal biological identity. Since identity and autonomy are essential parts of the human experience, these possible misinterpretations and unintended harms must be accounted for.
Chronic inflammation in prostatic tissues has been linked to a predisposition for the proliferation of pre-malignant and malignant epithelium of the prostate. Upregulation of transcription factor NF-kB and inactivation of the p53 signaling pathway are involved in the proliferation of malignant cancer cells. Studies suggest that NF-kB signaling pathways is involved in the development of prostate cancer by deregulating various physiological processes. In contrast, the p53 signaling pathway provides a resistance to changes in the genome, providing tumor suppressing capabilities through its ability to induce cell cycle arrest and initiate controlled cell-death in neoplastic cells. Betulinic Acid (BA), a triterpenoid found in the bark of several plants, has shown promise as a potential chemo-preventive agent by induction of apoptosis in various malignant cells. We investigated the involvement of NF-kB and p53 in BA-induced apoptosis in human prostate cancer cells. Treatment of androgen-responsive human prostate cancer LNCaP cells harboring wild-type p53 and androgen-refractory DU145 cells with mutated p53 and high constitutive NkB activity with 10 um and 20 um BA resulted in decrease in cell viability and induction of apoptosis. Inhibition of cell survival by BA occurred as a result of alteration in Bax/Bcl-2 ratio in both cell lines that led to an increased cytochrome C release, caspase activation and poly(ADP)ribose polymerase (PARP) cleavage. BA treatment resulted in the inhibition of NF-kB pathway and stabilization of p53 and increase in cyclin-dependent kinase inhibitor, p21/Waf1. Furthermore, treatment of prostate cancer cells with BA decreased the phosphorylation of IKKa and IkBa inhibiting the nuclear location of NF-kB/p65 causing cytosolic accumulation and resulting in its decreased nuclear binding. These effects of BA demonstrate its anticancer capabilities and prompts further research into its role in the prevention and treatment of prostate cancer.
Abstract

The purpose of this research was to determine the light harvesting efficiency of two different architectures of perovskite solar cells, planar and mesoporous. It was also to determine the variation of grain size among these two substrates with varying concentrations of methylammonium chloride additives. This was done using UV-vis spectrometry and scanning electron microscopy. It was discovered that the light harvesting efficiency of the mesoporous cells were higher than that of the planar cells by 5-10% and that the grain size of the planar cells were susceptible to significantly larger crystal growth. This indicates that the larger surface area leads to higher absorption of light, however not by a significant amount. More measurements of the overall efficiencies and incident photon-to-electron conversion efficiencies of both device types will be needed to see if the larger crystal size on planar solar cells will yield higher quantum efficiencies and overall device efficiencies.
Introduction and Methods
At the CWRU ITMM lab, a major point of focus has been, and continues to be S-nitrosothiols. S-nitrosothiols (SNO), characterized by the binding of nitric oxide to a cysteine thiol, are known to be associated with a wide range of regulatory roles within the human body. One such role includes the regulation of local blood flow, however, it should be noted that this is not SNO's only role. SNO, in general, is known to play a role in the post translational modification of a plethora of proteins. As such, the dysregulation of SNO is known to be associated with a wide variety of pathophysiological conditions. My specific study focuses on the role of SNO in cardiopulmonary bypass procedures (CPB). Following CPB, patients are often found to have systemic inflammatory responses, and major organ dysfunction. It is thought that SNO levels may be negatively impacted in patients undergoing CPB due to some of the procedures inherent to bypass surgeries. To test this, I will be going to UH and consenting patients to participate in the study, and then obtaining blood samples from the patient before and after a CPB-requiring surgery. I will then bring the blood samples back to the lab and run several analytical tests to measure certain characteristics of the blood, including Total NO levels, FeNO levels, SNO levels and tHb levels. For measuring NO levels, a triiodide-chemiluminescence procedure will be used, while a co-oximeter will be used to measure tHb.

Results and Conclusion
There is no significant trend in Total NO, FeNO, or SNO following CPB procedures. However, within the cohort, all but 1 participant showed a drop in tHb from pre-bypass to the next morning. To come up with any significant conclusion, all the blood samples must be tested for NO levels, however, these initial results with regards to NO and tHb are interesting none the less.
The electric guitar market is saturated by expensive instruments with costly, unnecessary features. As a result, guitar sales are being driven by buyers who can afford to settle for nothing short of a four-figure price tag. Meanwhile the target demographic for sales, men under thirty, is buying fewer and fewer guitars every year.

My objective is to design an electric guitar to be brought to market that delivers extraordinary customer satisfaction and is competitive in the marketplace. To attract young buyers, the instrument will sport a fast yet comfortable neck and crunchy high signal output. The design will be reliable and playable while minimizing weight and eliminating unnecessary design elements. By trimming the fat, I will create a quality instrument able to retail under $700 for the purpose of attracting young buyers who would otherwise purchase used or budget-line guitars.

A process by which to manufacture a prototype will also be developed. A prototype will be produced in order to verify that design requirements have been met. The prototype would also be used for marketing and advertisement purposes to increase customer demand for the new model, however this is outside the scope of this project. Finally, methods to scale up the manufacturing processes for full scale production will be developed.
French playwright Yasmina Reza once said, “Theatre is a mirror, a sharp reflection of society.” This insight especially applies to the modern theatre – for example, that of Berthold Brecht and Eugene O’Neill. As such artists grappled to come to terms with post-World War I society, they crafted their own definition of life and justice. Using theatre as their medium, modernist playwrights worked to convey these newfound truths. The modern introduced an experimental layer to many art forms, which – in the work of modern playwrights – led to new conceptions of challenging the viewer and thus of challenging the conventions of Bourgeois theatre. In addition, whereas painting, sculpture and films create distance between the work and the viewer, playwrights and directors were enabled by technological shifts of the early twentieth century to provide an immersive, live experience that could truly resonate and connect with viewers. Modern plays in these ways advance societal change and inspire offstage, real-life dialogue in society. This presentation will demonstrate that the modern theatrical arts revitalize the way people interact with and interpret the world.
**Title**

**PPP2R3A Gene Regulates EMT Marker Expression**

**Abstract**

Protein phosphatase (PP2A) is a heterotrimeric phosphatase that serves as the negative regulator to many oncogenic signaling cascades. PP2A functions as a tumor suppressor and its inactivation by the endogenous inhibitors CIP2A and SET is associated with cancer. As previously mentioned, PP2A consists of three subunits which are the structural "A" subunit, the regulatory "B" subunit, and the catalytic "C" subunit. The regulatory “B” subunit is encoded for by four different families of genes which are the following: the B55 family, the PR family, the STRN family and the B56 family. Each family contains several genes which encode for multiple B subunit isoforms, thereby resulting in over 60 distinct holoenzymes. Each holoenzyme has a unique substrate specificity, resulting in distinct downstream activity. This study focused on the PPP2R3A gene, in the PR family, and its regulation of epithelial-mesenchymal transition (EMT) marker expression. EMT is a biological process that has been shown to occur in the initiation of metastasis for cancer progression. Epithelial cells are polarized cells that interact with the basement membrane through their basal surfaces. They line the surfaces and cavities of blood vessels and organs and are responsible for activities such as secretion, selective absorption and transcellular transport. In EMT, epithelial cells lose their essential characteristics, such as cell-cell adhesion and cell polarity, and instead become mesenchymal cells that are migratory and invasive. Previous studies have suggested that the holoenzyme formed as a result of the PPP2R3A gene is responsible for preventing EMT in a lung cancer cell line. This study employed an shRNA virus to knockdown the B subunit produced by the PPP2R3A gene and determine its effects on EMT marker expression in an endometrial cancer cell line. It was hypothesized that upon removal of PPP2R3A gene expression, there would be an increase in mesenchymal cell markers and a decrease in epithelial cell markers, since EMT could take place freely. The data from this study not only provides an insight into the possible regulators of a process that is responsible for the initiation of metastasis in cancer progression, but also highlights the significance of a single B subunit isoform of PP2A on the regulation of this biological process.
### Abstract

This paper explores how Greece’s small business owners have been affected by the 2009 financial crisis through an anthropological perspective. The culture of Greece makes the economic priorities of many small business owners inherently different from the those of the Greek government and the European Union. This problem is exacerbated by the enhancement of Western ascribed identity and the increasing presence of hegemonic power dynamics. The combination of an increase in globalization, the pervasive nature of Western thought within the EU, and the Greek historical and sociocultural background have driven the economy towards focusing on tourism, a trade that relies on circumstantial economic and geopolitical factors. Focusing on the dichotomy between the public and private spheres of the political economy, I explored how Greek culture influences how small businesses prioritize and function within these harsh economic conditions.
**Elevator Speech**

SHPE’s vision is to empower the Hispanic, Latino and Minority community to realize its fullest potential and to impact the world through STEM Awareness, Access, Support, and Development.

SHPE’s mission is to create a Case Western Reserve and Cleveland community where Hispanic, Latino and Minority members are highly valued and influential as the leading Innovators, Scientists, Mathematicians, and Engineers.

**Key Words**

- Engineering Society
- Latinx community
- STEM advocacy

**Abstract**

The Society of Hispanic Professional Engineers, Inc. is a non-profit nation-wide organization dedicated to increasing the participation of college students in the fields of science, technology, engineering, and math (STEM). The National organization is composed of individual chapters all throughout the nation, from High School to Professional Levels, which invest in creating a richer and more diverse professional environment for all underrepresented minorities in STEM fields. In our chapter, we utilize the programming of the National chapter to develop the leadership skills of our members. Some of these programs include Regional Leadership Development Conference (RLDC) the National Conference, and the National Institute for Leadership Advancement (NILA).

Please, fill free to research more about these resources at www.shpe.org.
## Abstract

**Background:** Information on risk factors, incidence, and survival of eccrine malignancies is limited. The objective of the current study was to describe the incidence of and survival from primary eccrine malignancies.

**Methods:** We used data from the 18 registries of the Surveillance, Epidemiology, and End Results (SEER) Program from 2000 to 2013. Diagnoses of malignant eccrine spiradenoma, eccrine papillary adenocarcinoma, eccrine poroma, and eccrine adenocarcinoma were included and analyzed discretely. The cause of death, relative frequencies, five/ten year survival rates, and incidence rates were calculated. Each parameter was analyzed by age, specific type of eccrine malignancy, residence location (urban/metropolitan), race, sex, and SEER Registry.

**Results:** Overall age-adjusted incidence was .10 per 100,000 person years. The incidence of eccrine carcinoma increased significantly (approximately +3.23% annual percent change) from 2000-2013. Incidence among men was significantly greater than women (95% CI of rate ratio: 1.35-1.65). Incidence among white-Americans was significantly greater than non-white Americans (95% CI of rate ratio: 1.21-1.63). Five-year relative survival of eccrine carcinoma was 92.88% (95% CI: 94.10%-97.48%). Increased age, male sex, black race, rural (as opposed to metropolitan) residence, and occurrence of malignant eccrine spiradenoma (as compared with papillary adenocarcinoma, poroma, and adenocarcinoma) were associated with significantly higher all-cause mortality (p<.01).

**Conclusions:** This is the largest population-based study of eccrine malignancies to date. Although the overall incidence of eccrine malignancies is increasing, the overall mortality has decreased. Recognition of the unique demographic profile of eccrine malignancies as per this research is crucial in understanding the etiology of different eccrine malignancies and determining how to prevent and care for this disease in the future.
**Title**: HoloAnatomy

**Elevator Speech**: Medical faculty and researchers have touted Microsoft HoloLens as the next big transformative change in medical education, and likely in education in general. Experience a Microsoft HoloLens demonstration to see how this “augmented reality” device mixes the digital and real world in a new medical anatomy education tool.

**Abstract**: “HoloAnatomy,” is an augmented-reality demonstration app for Microsoft HoloLens, which Case Western Reserve University (CWRU) views as the future of medical anatomy education. HoloAnatomy, developed by CWRU and Cleveland Clinic, is the first third-party HoloLens app to appear in the Microsoft store. The HoloAnatomy app is only a brief glimpse into the full anatomy curriculum that is currently under development by teams of computer programmers, artists, anatomy experts and others at CWRU and Cleveland Clinic. This digital anatomy curriculum using HoloLens technology profoundly enhances and expands the medical learning experience and potential. The Microsoft HoloLens blends the digital world with the real world through a headset that projects holograms into the wearer’s visual field for a highly realistic and immersive experience. Students are able to explore human anatomy through a dynamic journey through the body. Digital models will provides an opportunity for robust simulations of living tissues, including physiology and biochemical processes. It will enable them to extract or expand particular organs or systems, view the body from a range of angles, and enable exploration without the fear of making a mistake.

Most importantly, HoloLens enables this exploration to occur on a social level. Students are not closed off from the world or the people around them when they wear HoloLens. With this “augmented reality” device, the transparent visor of the headset allows wearers to see and hear each other and see their “real” environment as they simultaneously interact with a digital anatomy model together as a group—just like they experience in a traditional lab setting. Case Western Reserve University will fully roll out this digital anatomy curriculum with the opening of its new Health Education Campus in 2019, a $515 million building being constructed in partnership with Cleveland Clinic.
Everykey is an innovative universal access device for everything you own that requires a physical key or password. Everykey is a Bluetooth Low Energy enabled device that allows for immediate access to a user’s smartphone, tablet, computer, and even house door, car door, bike lock, and other controlled access devices.

When Everykey is within range of one of the user’s devices, it will allow the user to bypass that device’s password or physically unlock it, eliminating the need for complicated passwords and cumbersome keys. Everykey also stores a password keychain which can be used to seamlessly log the user in to their online accounts when they’re close to one of their devices. When Everykey goes out of range, the device will re-enable its security mechanisms, so it is safe and secure when out of trusted hands. In the case of loss or theft, the Everykey can be ‘frozen’ by either calling in or going to our website. There are multiple accessories for the Everykey, including a key ring or a wristband.
Small-mouthed salamander population dynamics under anthropogenic pressure

This research will help ecologists and land developers quantify the amount of land necessary to help sustain existing populations of amphibians and to assess the efficiency of forming new habitats when previous land has been destroyed.

Reducing habitat can be detrimental to a species, however creating habitat may help alleviate the pressure of limited resources. Many ecologists have begun researching the quantity and the use of forming new habitat that a species requires in order to maintain their population. We investigated the effects of anthropogenic habitat modification on the population dynamics of small-mouthed salamanders (Ambystoma texanum), as part of The Northeast Ohio Sewer District’s Euclid Creek and Dugway Storage Tunnel construction project. The purpose of our study was to compare changes between two different areas. One area experienced habitat destruction, where forested habitat was removed. The other area experienced habitat creation, in which a new wetland was built. Every year since 2012, we have been estimating the number of breeding adult salamanders at these sites. We predict that due to the activities of the project, there will be a decrease of breeding salamanders in the location where habitat was removed and an increase of breeding salamanders in the location where a new wetland was created. Results from this study will help ecologists and land developers quantify the amount of land necessary to help sustain existing populations of amphibians and to assess the efficiency of forming new habitats when previous land has been destroyed.
Inflammation in adipose tissue leads to insulin resistance (IR) and diabetes. Growing adipose tissue that is not properly vascularized due to insufficient angiogenesis becomes ischemic, secretes pro-inflammatory signals, and promotes the local inflammation that can further modify the function of the adipocytes. Inflammatory changes in the pancreas also develop before IR. Previous work, in vivo, suggests that microRNA-467 (miR-467) reduces inflammation caused by hyperglycemia. The current work aims to understand what cell types and tissue is responsible for the protective effect of miR-467 by studying the effect of high glucose, miR-467 mimic, and miR-467 antagonists on macrophages, pancreatic beta cells, and adipocytes. Each cell type was glucose stimulated and examined for the relative presence of TSP-1, an antiangiogenic and pro-inflammatory protein whose translation is suppressed by miR-467 upregulation. Our in vitro experiments reveal TSP-1 levels decreased in macrophages following glucose stimulation suggesting upregulation of miR-467 due to high glucose that suppresses the translation of TSP-1. TSP-1 was not decreased after exposure to high glucose in the pancreatic beta cell and adipocyte cell lines, suggesting that miR-467 is not produced in these cells. ELISA will be used to measure secreted pro-inflammatory proteins and chemokines in supernatants of macrophages and pancreatic beta cells. RT-PCR will be used on lysates to measure the presence of miR-467. We expect to see lower levels of pro-inflammatory proteins and chemokines in pancreatic beta cells and macrophages exposed to high glucose, and higher levels of miR-467 in the cells exposed to high glucose. The macrophages will be transfected with a miR-467 mimic and miR-467 antagonist and will be placed in high glucose media. These expected results will provide us with the cell types directly affected by miR-467 and establish that miR-467 and TSP-1 mediate the responses to high glucose in these cells.
The process of mixing fuel and air in the most efficient ratio in engines is critical to an engine’s market viability. This project seeks to develop a system to convert an engine from mechanical to electronic fuel injection, thus increasing its value, efficiency and longevity.
The oxygen reduction reaction on a Pt(111) surface is believed to have an intermediate of OOH(ads) in acidic media with an onset potential of 0.8-0.9 V on the reversible hydrogen scale (RHE). In alkaline media the onset potential based on cyclic voltammograms and polarization curves from experimental studies is within the same range. This could imply that the intermediate in alkaline media is also OOH(ads). In this theoretical study a Pt(111) surface with 1/6 ML of OOH(ads) with no co-adsorbed water, 1/6 co-adsorbed, and 1/3 ML co-adsorbed water present was studied, as well as the Pt(111) surface with 1/6 ML of O2 with these water coverages. The OOH was calculated to have reaction energy of dissociation that would be consistent with an effective reversible potential of 0.8-0.9 V (RHE). The first electron reduction intermediate in the ORR in alkaline media is OOH(ads).
Abstract

The purpose of this investigation is to understand the role that Short Chain Fatty Acids (SCFAs) play as modulators of host defense, and specifically whether they affect intestinal epithelial barrier function. Dr. Levine’s laboratory has previously shown that a person with HIV has a significant increase in their gut permeability due to the weakening of the tight junctions as a result of the disease progression. Thus, there is a need for a therapeutic treatment that can improve barrier function not only for HIV patients, but for a wide range of diseases and disorders. Since SCFAs have been shown to be beneficial during gut inflammation, we hypothesize that SCFAs play a direct role in the health of the epithelium by modulating the epithelial barrier function in a receptor mediated manner. Experimental aims have been outlined and are to determine whether SCFA receptors are expressed on intestinal epithelial cells, assess SCFAs ability in modulating barrier integrity, and to explore how the supplementation of SCFAs can lead a change in barrier function. The experimental results thus far reveal that SCFA receptor genes are expressed on intestinal epithelial cells. Furthermore, the experimental results demonstrate that SCFAs can modify the permeability of the intestinal barrier by altering the expression of tight junction protein genes. The current published literature exposes a complex relationship between SCFAs and intestinal epithelial barrier function, thus this study set out to explore the role that SCFAs play in maintaining the health of the epithelium.
Efficient product design is dependent on the quick translation of geometric changes into new parts and prototypes. As a result, rapid prototyping is an essential step to any product development process. Three-dimensional (3D) printing and machining with computer numeric control (CNC) are two popular rapid prototyping methods, as both allow for quick iteration through designs, saving both time and cost.

3D printing involves additive manufacturing, which allows for the creation of more intricate geometries than subtractive manufacturing. Additionally, parts are easily customized, as they do not require any molds or tooling like traditional plastics. CNC machining, while subtractive, provides superior surface finishes and high precision.

The advantages of each make them ideal candidates for integration. The goal of this project is to effectively integrate both 3D printing and CNC machining capabilities into one low-cost, desktop-sized device using shared x/y/z-positioning hardware and software, along with interchangeable heads.

The final design was reached using an iterative design process, aided by a technical breakdown of 3D Printer and CNC subsystems. The design incorporates four NEMA 17 stepper motors. Because of their excellent positioning and speed control, stepper motors are ideal candidates for a 3D printing/CNC application. The motors are controlled using an Arduino Uno microcontroller. CAD geometry is transferred from stereolithography to g-code using the online software program, “MatterControl”. The g-code is transferred to the Arduino using an SD card.

Aside from the CNC/3D printing interchangeability, the device has been designed to be simple, intuitive, and easy to assemble. Because it is meant to function as both a CNC machine and 3D printer, component modularity is essential for success.

Once complete, the device will be evaluated using a series of SolidWorks test parts with specified tolerances. A statistical analysis of its accuracy will be presented.
Traditionally, the fishing net design has not been radically changed since its inception. As a result, steelhead anglers today grapple with the inconvenience of big bulky nets that are prone to corrosion and get caught on flies and bushes. This is relevant to approximately 3.8 million fly fish anglers in the U.S. today. A portable, collapsible fishing net was developed to address the current issues experienced with the fishing net. Lighter, corrosion resistant materials are used in conjunction with a combination of telescoping and folding sections to address the main design issues in current fishing nets on the market today. The final design has a net opening of 12" by 24" inches that can hold a fish of up to 36" long and 20 lb in weight. The net can collapse down to an envelope of 9" by 3" from an open size of 13" by 25". This reduction in size is achieved by holding the net between two circular arc telescoping rods in an oval shape. These two rods fold together to allow the 4 segments of each rod to collapse together. After the net holding rods are collapsed, the handle of the net folds between them to reach the final dimensions. This compacted position of the net allows for easier carrying while fishing and more efficient storage for travel. Spring buttons will lock the fishing net in the open position, preventing the net from closing while in use while still allowing the net to be opened with one hand.
Validating the Expression of Genes in the Stria Vascularis Using In Situ Hybridization

Using in situ hybridization, approximately 25 genes were validated and they can be used as molecular biomarkers for intermediate cells of the developing stria vascularis. Understanding the particular genes expressed in the stria vascularis and at which stages they are expressed will potentially lead to future strial regenerative therapies.

The stria vascularis is a specialized epithelial structure of the mammalian cochlea that produces endolymph, a potassium rich fluid responsible for the positive endocochlear potential of the scala media. This positive extracellular potential is the major driving force for proper signal transduction by mechanosensory hair cells and thus normal hearing. However, despite the stria vascularis importance in normal hearing, it has not been the focus of many studies. This projects aim was to validate the expression of candidate genes involved in the development of the stria vascularis through In Situ Hybridization. This project identified approximately 25 genes that can be used as molecular biomarkers for intermediate cells of the developing stria vascularis. The expression of the genes varied significantly by stage and this might be the result of gene suppression. Further testing is required to determine conclusively the difference in gene expression by stage.
The role of chemical biology in non-invasive brain stimulation: A review

Non-invasive brain stimulation (NIBS) is used in research to measure function of the brain and promote neurological recovery in stroke and spinal cord injury patients. However, the mechanisms underlying NIBS remain largely unexplored. This study aims to explore the chemical background of NIBS in order to assist in future clinical studies.

Key Words
- non-invasive brain stimulation
- literature review
- stroke

Abstract
Non-invasive brain stimulation (NIBS) is a widely used methodology in neurological research. NIBS is utilized to measure function of targeted brain networks and promote neurological recovery in chronic stroke patients and spinal cord injury patients. However, despite NIBS widespread use in clinical and research settings, mechanisms underlying NIBS remains essentially unexplained. This study aims to explore the chemical background of NIBS and give the theoretical framework to perform future clinical studies.
This project tested the practical application of a system comprised of Intel Edison boards, an android Nexus 6 cell phone, and local and public servers. The system is expected to send and receive packets of data to and from the cell phone and Intel Edisons and their sensors and actuators through local and public servers. Multiple Edison boards were then tested within the system in an effort to determine if the system’s communication deteriorated.

This system has seemingly limitless applications. Home applications are possible if users are concerned with security, energy conservation, or home automation. Industrial applications are also possible if businesses want to monitor and control manufacturing processes, energy efficiency, or office automation.
**Title**
An Application-Based Intervention for Personal Happiness Improvement

**Elevator Speech**
Our Happiness Checker iOS application allows users to assess their happiness using a programmable daily check-in survey. Data collected from the survey can be visualized on the iOS application to allow users to see trends in their happiness. This information lets users make lifestyle changes to improve their lives.

**Abstract**
Much of happiness is determined by intentional activity, and with assistance of a mobile application, an individual may be able to improve their happiness. With our Happiness Checker application, we strive to both quantify and also improve the user's general happiness. We are creating an iOS application with Apple Watch capabilities to assess the user’s day to day happiness in order to better understand the general wellness of the user. The application will have a programmable daily check-in survey based on Wessman & Rick's 'Personal Feelings Scale'. Data collected from the survey can be visualized on the iOS application to allow users to see trends in their happiness and give them a sense of when they are struggling. The application will also have emergency contact information for resources (hotlines, general health care providers, etc.), and meditation and breathing exercises available to users at a difficult time. Reminders can be set to do a breathing exercise or to find time to meditate. Future renditions could lead to connecting the user's information with their primary health care provider in order to better start the communication about general happiness and mental health between patient and healthcare provider.
Human beta-defensin 3 (HBD3) is a peptide that is most commonly produced by epithelial cells. It acts as an anti-microbial and its primary role is to remove pathogens. It can be induced by factors like inflammatory cytokines, microbial products or epidermal growth factors (Garcia et al., 2001; Sorensen et al., 2005). It has also been shown to have high levels of expression in various forms of cancers. The purpose of its presence in tumors is highly debated. It has recently been discovered that HBD3 is present in high concentrations in glioblastoma (GBM) tumors. GBMs are highly aggressive and invasive brain tumors with extremely low survivorship. In order to further understand the role of the high levels of HBD3 production in GBMs we attempted to determine the receptors to which HBD3 may be binding. We looked for the presence of CD98, CCR2, and CCR6 receptors within the tumor sections using immunohistochemistry staining. We confirmed the presence of all three receptors. We then tested for co-localization of the receptors and HBD3 using immunohistochemistry and immunofluorescence staining. Our results showed no co-localization of HBD3 with CCR2 and CCR6. Immunofluorescence showed that there was potentially binding between CD98 and HBD3 on tumor cells. HBD3 staining was also demonstrated on macrophages that were identified by CD68 staining. Further binding studies and protein assays need to be done to determine the signaling modalities present when HBD3 is secreted.
Insights into the neural activity enabling feeding in certain animals can be extended to neural behavior in other animals, including humans. To make sense of electrical recordings, spike sorting—the automatic grouping of spikes into groups from one neuron each—is necessary. No perfect spike sorting technique has been developed. I set out to look into preexisting techniques and use the information obtained to develop an algorithm ideal for spike sorting in our animal of interest, Aplysia californica. In my lengthy project, I have tested the free wave_clus program, and tried writing programs utilizing principal component analysis, wavelet analysis, and amplitude cutoffs. The amplitude sorting algorithm, one of the most promising, provides the basis for the full algorithm I am currently working on, in which I will also include the timing data analyzed by Jonathan Sasse. The developed algorithm will aid, not only in the furthering of the work of our lab, but by extension, the advancement of neurobiology research.
The purpose of this project is to learn something new about naval architecture by combining 3-D printing with 19th Century ship plans. The ship that I am attempting to model is the HMS Daphne, which was involved in the suppression of the East African slave trade in the mid-1870s. This past summer I traveled to the United Kingdom and managed to obtain photographic copies of the Daphne's blueprints. It is my belief that a 3-D copy of this ship will be able to illustrate how these ships were built and operated. There are several architectural aspects of the Daphne that I have a particular interest in learning about, such as the significance of hull shape and keel size. While the 3-D printing process has taken longer then expected, I plan on completing this part of the project by this upcoming fall.
Hypnotherapy is a pseudoscientific therapy method, dating back to the Victorian Era, which is used to send a client into a relaxed, more suggestible state with the intention of allowing the client to better understand their own subconscious. In popular culture hypnosis has often been thought to be useful in the recovery of repressed or “forgotten” memories. Although it is true that many clients undergoing hypnosis have reported memories that they did not remember prior to the therapy, scientific methods are unable to verify the authenticity of these memories. Additionally, in the cases in which these memories were found to be fictitious, the clients were found to have gained no benefits and may even lead to further trauma.
In this project, two synthetic routes to siloxy-functionalized silicon phthalocyanines are presented. Silation is achieved by replacing the hydroxy group of a dihydroxy silicon phthalocyanine precursor with the siloxy group of a prefabricated silanol. In the first synthetic route, a dimeric dihydroxy precursor was functionalized directly to the siloxy silicon phthalocyanine dimer. In the second route, the monomer is functionalized, which can then be subsequently condensed to the dimer. The resulting compounds were characterized by NMR spectroscopy and crystal structure. X-ray crystallography of crystallized siloxy functionalized phthalocyanine dimers yields structural data relevant to the study of pi-electron interaction between stacked aromatic rings.
A very common problem in the field of prosthetics is fit. When a prosthetic does not fit, it can cause pain and even sores for the patient. Making a force sensor with a piezoelectric material, such as zinc oxide (ZnO), that takes advantage of nanotechnology will mean sensors can be smaller and will not experience the hysteresis effects seen by other force sensors. They will also have the added advantage of not requiring a battery. It is therefore necessary to determine the best way to construct a nanoscale ZnO force sensor. The relationship between geometry and voltage output is not well understood for complicated piezoelectric nanostructures. This study investigates the relationships between geometry and voltage output of the ZnO nanowall networks. These findings from numerical simulations will later be compared with experimental results and applied to the development of a force sensor for prosthetics.
Metal matrix composites (MMCs) are in high demand across various industries for their high specific strength and stiffness, yet their production and manufacturing has not been optimized. One suggested manufacturing method to minimize production cost and time is squeeze casting or die casting. However, the particulate nature of Al-SiC MMCs give rise to concerns regarding the homogeneity, density, and porosity of a die-casted part. In order to look at the validity of these concerns and evaluate the viability of die casting as a manufacturing method for these MMCs this study utilizes MAGMA5, a program by Magmasoft. The program simulates the process and allows this study to produce an iterative model of die casted MMCs. This model is optimized for realism within the bounds of MAGMA5’s capabilities and, ideally, can give some indication of the viability of die casting for these materials. Starting with the most basic approximations of silicon carbide reinforcement and moving towards a close-packed structure of small particles, a series of ten simulations was run and compared based on several metrics. There are pouring temperature, solidification temperature, actual air pressure within the casting mold, air entrapment within the casting, porosity, and dispersion of flow tracer particles. These metrics are cumulatively able to provide a full picture of the success of each casting simulation and, when compared, show the progression of die casting’s success as each simulation becomes more complex. While there are several barriers to realistic embedded in the program, the results indicate that the die casting of a particulate MMC is possible.
A preliminary design study is being performed on a soft X-ray spectrometer to measure K-shell spectra emitted by a warm dense plasma generated on Axis-I of the Dual-Axis Radiographic Hydrodynamic Test (DARHT) facility at Los Alamos National Laboratory. The 100-ns-long intense, relativistic electron pulse with a beam current of 1.7 kA and energy of 19.8 MeV deposits energy into a thin metal foil heating it to a warm dense plasma. The collisional ionization of the target by the electron beam produces an anisotropic angular distribution of K-shell radiation and a continuum of both scattered electrons and Bremsstrahlung up to the beam energy of 19.8 MeV. The principal goal of this project is to characterize these angular distributions to determine the optimal location to deploy the soft X-ray spectrometer. In addition a proof-of-principle design will be presented.

Warm dense matter (WDM) is poorly understood and described, and is present in fusion experiments and stellar interiors. This spectrometer will help measure key parameters of the WDM to help develop a model of its equation-of-state that will permit a better understanding and characterization of the aforementioned phenomena.
Deep Learning Approach to Grass Identification

A self-mowing lawn mower was programmed to recognize areas that contain grass and do not contain grass in order to greatly improve its functionality. Deep-learning algorithms were used to help the mower recognize pictures of grass. The project was conducted on a Linux platform while the code was written in Python using TensorFlow. In order to allow the device to differentiate between grassy and non-grassy areas when presented with an image, the machine was taught common traits which were characteristic of grass. A significant amount of time was also spent collecting data and pre-processing images in order to construct a better algorithm for the robot. This algorithm was used to allow the robot to physically see the ground and identify grassy areas.

The ability of a lawn mower to identify grassy and non-grassy areas can prevent blade damage and save money with less blade replacements. Furthermore, self-driving lawn mowers, which possess the ability to differentiate between grassy areas, produce more efficient mowing and thus save the consumer time. While there are other autonomous lawn mowers on the market, they function by placing beacons and sensors around the area that needs to be mowed so that they do not scalp the area. The mower presented in this project has more universal usage and would not require special setup of beacons or sensors before being able to use it. Additionally, the data-collection and pre-processing algorithms used in this project have the potential to be applied to other industries where it is necessary to make split second decisions based on visual information. Altogether, this project provides a gateway into machine learning algorithms and their place in everyday society.
In the sport of competitive swimming, interval based training today is still controlled using old, rudimentary systems to keep track of the workout. Pace clocks, which only continually count up by the second for the athlete to calculate intervals, and expensive systems integrated with the timing system of the pool or facility are the only way athletes can keep track of their progress throughout the workout. A pace clock, the most used solution, causes confusion when having intervals that aren’t even/whole numbers like whole minutes, or 30 seconds, 15 seconds etc. Integrated systems are too costly and bulky to maintain. Our solution to improve the interval based workouts of a swim practice is a mobile phone controlled system that connects to a Raspberry Pi, which then displays relevant timing information to an LCD display. The system will be able to specify the exact interval a swimmer is on, and will count down to 0 and restart instead of just repeating 60 seconds over and over. Extra information like type of stroke, how many iterations, and time left until the next repetition will also be available for the athlete to view. This system is intended to be used prior to a workout by a coach, and during the workout by the coaches and team. Before practice, a coach can load a workout into the app, and when the practice starts, load it to the Pi/display to enable swimmers to train on repetitions. The system’s components are cheaper and more modern than other available workout managers and, through mobile integration, make our system easier to use for non-technical users.
Over one-third of all proteases can be classified as serine proteases, such as trypsin. Proteases classed as clan PA proteases (of which trypsin is a part of) perform proteolytic reactions using three residues that make up the catalytic triad, as well as two tetrahedral intermediates to hydrolyze peptide bonds. Streptomyces erythraeus trypsin (SET) is a bacterial serine protease that is 227 amino acid residues long. Leupeptin, a peptidyl-aldehyde substrate inhibitor, acts prior to the formation of the acylenzyme; leupeptin reacts with the catalytic serine, trapping it in a state similar to the tetrahedral intermediate. After refinement using Phenix and Coot, a structure of the leupeptin-trypsin complex is obtained and is found to be very similar to previously found intermediates. However, this intermediate is found to exist in two conformations. Interestingly, the oxyanion hole does not stabilize the intermediate, rather, the oxygen points out of the hole and to the histidine in the catalytic triad.
The campus assistant is an app to help students find and participate in exciting things on campus. This is accomplished by having information and excitement scores of campus buildings, study-locations, restaurants, and events available to users. User can ask questions to other users when the information exceeds the system knowledge.

The Campus Assistant is a web application designed to assist new and current students in finding useful and exciting things near campus by providing information about the campus and its surroundings. The app will allow users to provide ratings for entries in each category (campus buildings, study locations, restaurants, and events) based on criteria relevant to the category. An excitement level will also be provided for each event based on a time-weighted aggregation of emotion scores for individual comments on the event that will be calculated using the SenticNet emotion processing library. Directions will be provided to each one of these establishments and events upon the user’s request. The application will also include a question-and-answer feature which allows the student to post questions they have about the campus and its surroundings to a forum-like section where students can answer questions as well as rate other students’ answers.
In this paper, geometries of conformal cooling lines and the thickness of the cooling line to the core’s outer wall of 3D printed cooling cores used in die casting were calculated. Additionally, 3D printed cores that have already failed were analyzed using a scanning electron microscope to determine how cracks formed and propagated. The die casting industry is on the rise and increasing profits while decreasing cycle time benefits a number of industries, specifically the injection molding and permanent mold casting industries. 3D printed cooling cores with conformal cooling lines will allow die cast manufacturers to meet the needs of the rising industry.

The findings from this paper will be used to benefit the die casting industry by reducing core cost and cycle time. In order to optimize the geometry of the cooling lines, concepts from a helical heat exchanger were used. This allowed for an accurate derivation to find the ideal geometry based on a number of input factors. The ideal thickness between the cooling lines and the outside wall of the core was determined by limiting the thermal stress below the fatigue limit of the maraging alloy. While no studies have yet been conducted on the thermal fatigue of 3D printed cooling cores with conformal cooling lines used in die casting, understanding the thermal gradients will provide an accurate representation of how the core will react under thermal cycling conditions. Both the core thickness and geometry will be incorporated in a 3D printed model using clear plastic material. This will allow for easy visual representation of the cooling core while water flows through the cooling lines. 3D printed cores that have failed will be analyzed using a scanning electron microscope which will reveal how and why failure occurred. This will be beneficial in redesigns of 3D printed cooling cores. Ultimately, the findings of this study will be applied by the die casting industry and will lead to shorter cycle times and lower costs.
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**Abstract**

The purpose of this research was to observe the metal-ion melanin interactions of lead (Pb) with multiple different forms of melanin. While melanin is commonly known as a biological component that affects pigment in humans, it also performs numerous additional important biological functions. It has been shown to bind to metal ions and other toxins that must be disposed of by the body. The goal was to investigate and differentiate the binding abilities of melanin that was biologically, commercially, and synthetically obtained. This was done by observing the EXAFS produced by these different types of melanin. The structural properties of these different kinds of melanin could be compared using this technique. The data collected indicates that the hypothesized structure of melanin was not observed during these experiments. However, the structural properties of these three types of melanin were similar.
This research uses content clouds to examine food procurement preferences among different neighborhoods in Cleveland and East Cleveland, OH. We predict the variety of food (largest procured food content cloud) increases as the number of food stores visited in each neighborhood increases (largest food procurement store content cloud). We also predict the variety of food increases with the number of available stores. According to this hypothesis, the neighborhood of Broadway should have the largest content clouds for both procured food and stores. Our sample consisted of 30 residents who receive Supplemental Nutrition Assistance Program (SNAP) benefits. Residents participated in semi-structured interviews regarding food procurement behaviors and were categorized by residing neighborhood for comparison. Content clouds were generated from the interviews using TagCrowd.com to identify the food retailers visited and the most frequently obtained foods. Two sets of content clouds (n=12) were analyzed according to commonly listed food items, and where these items were procured. Across all neighborhoods, the most frequently mentioned foods were chicken, unspecified meats, and fruit, while the most frequently mentioned store types were supermarkets and discount grocery stores. We found a positive correlation between variety of food and variety of stores among the thirty participants, which may suggest that the more stores visited, the greater variety of foods procured. There was no relationship between the number of available stores in each neighborhood and the food variety or store variety mentioned by the participants. The expected relationship between number of available stores and food and store variety was not shown, which may be because SNAP participants are limited in their food procurement store habits: the number of available stores in a neighborhood is not necessarily related to the number of stores accepting SNAP coupons.
The purpose of this project is to develop a robust heart beat detection algorithm for ambulatory monitoring using sensors developed by Byteflies. The need for this project was highlighted by a demand for portable clinical monitoring and the lack of precision of current commercially available wearable devices. The Byteflies platform is a wearable system designed to provide real time monitoring of patients' vitals using electrocardiogram (ECG), photoplethysmogram (PPG), and on-board accelerometer signals. Our approach is to develop algorithms to process the raw data from these sensors to produce an accurate heartrate waveform. We then perform data fusion of three sensor datas to reduce the false positive of heart beat detection. To validate the data fusing algorithm, our group gathered gold standard vital data using Byteflies devices and Philips monitors for gold standard reference. Overall, this approach demonstrates potential for significantly reduce false positive of beat detection of noisy signals during movement.
Abstract

A power supply that has three different outputs coming from a single 12V nominal input. The design consists of buck, boost, and buck-boost converters. The design was developed as a printed circuit board using Altium software and will be tested mainly on its efficiency.
In this project, X-ray absorption fine structure (XAFS) was used to analyze the local chemical environment of molybdate and thiomolybdate that has been adsorbed onto pyrite. XAFS is a form of spectroscopy that uses an X-ray beam to excite core elections which then scatter and create destructive or constructive interference between the returning and leaving elections. This interference influences the absorption spectra that is analyzed using the graphing computer programs of Athena and Artemis. Athena was used to fit and merge multiple data sets while Artemis was utilized to take this merged data and generate calculations. The overall objective was to use these calculations to increase our understanding about the interactions between the molybdate and pyrite.
For our project, we are designing process flow diagrams on Microsoft’s Hololens, a headset that projects augmented-reality holograms. The process flow diagrams on Hololens could be used as educational tools or for process design purposes. We are implementing different pieces of equipment that would likely be used at a chemical engineering plant. Our program allows for easy addition of different components that are used in process flow diagrams. The Hololens allows us to plan out 3D space utilization by sizing various pieces of equipment and arranging them most efficiently. Process flow diagrams in 2D often become quite complicated, so our project will enhance the ability to understand and design complex processes. This project will improve the ability to design chemical processes and utilize space at chemical engineering plants effectively.
Abstract
The current computer peripheral market sees the absence of a highly customizable pointing device available for consumers. There are many benefits to a peripheral like this due to the proliferation of unique software that is implemented on computers. Professionals who use specialized software that makes heavy use of keyboard shortcuts will find improvements to their productivity as many shortcuts are moved right to the user’s fingertips. Computer gamers are also looking for a way to gain the edge over their competitors. Finally, expansive customization will benefit those with tactile disabilities that impede the use of traditional mice due to reduced or complete loss of functionality of digits.

The solution researched is an ultra-modular computer mouse. A base module consists of the palm rest and contains the circuit board used to communicate with the computer (wired). The base module contains bays in which control modules can be attached. The five control modules are the main source of customization of the mouse. Modules feature buttons, joysticks and scroll wheels in many different configurations in order to create a complete customizing experience. Without tools the control module is able to be removed and replaced with another module that contains the user’s desired array of controls or buttons.

Semi-functional prototypes were printed on a Monoprice IIIP 3D printer. Constant access to the machine, cost of PLA, and ease of printing with PLA were the main driving factors to choose this particular 3D printer. Five sample ergonomic shapes was studied and then one was selected as a balance of volume and comfort to the user. Sample prototypes were also printed to demonstrate the mechanism with which to change the modules. As well as being able to survive a 3-foot drop without unintentional ejection of the modules, the design optimizes cost to manufacture ($120), comfort, and durability.
Abstract

The field of energy is always growing. We are attempting a concept that has not been tested before, a three rotor wind turbine model. This high-efficiency, multi-rotor wind turbine has three coaxial, independent, contra-rotating rotors with three blades each. It is supported by a tower constructed of legos as well as a 3D printed casing to hold the nacelle. This project is supervised by Professor Mario-Garcia Sanz in the department of Electrical Engineering and Computer Science at CWRU. The success of this project is determined by the completion of a functional prototype that has a higher efficiency of energy conversion than the traditional design to warrant the increased capital cost of the wind turbine. The scope of this project consists of designing, building, and testing a three rotor model turbine. Each set of blades are different sizes growing in 25 percent for each rotor. Additionally, the middle rotor will spin in the opposite direction of the other two rotors in order to reduce the amount of torque experienced by the tower.

It is impractical to design and build a full scale wind turbine to test our experimental design, so our design is a scale model constructed using 3D printed parts and legos. The physical design and experimental validation is done in the Control and Energy Systems Center (CESC) wind tunnel. Maximum power point tracking control is used for the multi-rotor coordination. A continuation of this project will lead to prototype adjustments that include number of rotors, direction of rotation, distance between rotors, and more in order to maximize efficiency.
Snapet, short for Snap Expense Tracker, is designed to be an iOS application for personal expenditure management. Snapet will help users visualize where the money goes and keep track of income and expenses. It can automatically fill the expense fields by scanning the receipt or uploading the statement. Although there are many expense tracking apps in the market, most of them do not support smart scan feature and those supporting this feature either charge a high subscription fee or designed for business use. Therefore, the goal of Snapet is to implement a cheap, number-entering-free and self adaptive application to satisfy customer’s need of managing daily life expenses easily.
Upon intravascular administration, efficacy of particulate drug systems depend upon margination of the particles from the bulk of blood flow towards the vascular endothelial wall, to act at the wall or, if needed, extravasate to work in the tissue compartment, beyond the endothelial barrier. While the majority of particulate drug delivery systems are developed in the nanoscale domain, several mathematical models have indicated that nanoscale particles may face challenges to marginate past the RBC volume in bulk blood flow. Computational studies have also indicated that along with size, particle geometry can majorly influence this margination, as well as, wall-adhesive interactions under hemodynamic flow environment. Rationalizing from such studies, we chose to investigate the effect of particle shape and size to their margination and wall-adhesion under simulated hemodynamic flow conditions, utilizing model polystyrene particles of various nanoscale and microscale dimensions and surface-coated with biotin to allow their adhesion onto avidin-coated substrate surfaces in appropriate microfluidic set-up. Our experimental results indicate that microscale anisotropic particles have a significantly higher ability to marginate through the RBC volume to the wall surface and have higher adhesive interactions at the wall to undergo enhanced localization. These studies strongly establish the importance of particle size and geometry in vascular margination and wall interactions, and thereby provide critical design guidance to drug delivery systems.
Staphylococcus epidermidis and its biofilms are responsible for a wide variety of pathogenic morbidities and mortalities in human and veterinary medicine. The molecular changes accompanying biofilm formation and maturation are not well defined. Here, using Raman spectroscopy, we report detailed spectral data comparing the molecular characteristics of samples of Staphylococcus epidermidis RP62A planktonic and biofilm cells and note major changes between the spectra. Concurrently, we introduce an efficient and economical new protocol for obtaining Raman spectra of samples of planktonic bacteria and biofilm. Our method yields reproducible results and is based on rapid washing and freezing in order to attenuate continued metabolic change during the processing of bacterial samples.
Robotic locomotion has always been a tradeoff between speed, simplicity, and rough-terrain navigation. Wheeled robots are relatively simple and fast while legged robots perform well in rough-terrain navigation. One alternative, wheel legs, are a set of rotating spokes driven similarly to wheels. These devices merge the simplicity of wheels with the terrain navigation of legs, but have been slow compared most wheeled robots and fast legged robots.

This presentation shows the design of a fast wheel-legged vehicle capable of speeds seen in the fastest legged robots. The presented vehicle has four four-spoked wheel legs driven by a single motor. Relative torsional motion between wheel legs is allowed through a pre-torqued torsional spring bounded from zero to 22.5 degrees, allowing both in and out of phase “stepping” of the spokes. Each spoke has a pre-compressed linear spring to reduce the force of stepping by allowing the spoke to compress during high-force impacts. While some legged and wheel-legged robots are only stable at high speeds, a gear shifter allows the vehicle to perform at a wide range of speeds and accelerate from a complete stop. This vehicle is the first to connect simple, fast locomotion with stable rough-terrain navigation in such a way.

This presentation also provides a mathematical model to determine the vibrational characteristics of the vehicle. This mathematical model can be used as a design tool in creating robust designs for wheel-legged vehicles. The system of equations created by the lagrangian equations of motion and constraint equations is simplified then solved numerically for the second-order time-derivatives of all generalized coordinates using matrix algebra in MATLAB. The simulation takes place in a two-dimensional space to yield results on heave (or bounce), surge, and pitch. Contact forces with the ground and the stops of both the torsional wheel leg springs and linear spoke springs are modeled as spring and damper couples.
The Importance of the Home Literacy Environment: A Literature Review

An alarming number of our population is functionally illiterate. At this level, people may struggle to read a bus schedule, medicine bottle or job application which highly impairs their ability to function in society. This literature review compiles relevant literature that examines the home literacy environment and how that influences young children’s ability to learn.

Being literate is something that most people in our society take for granted. In reality, an alarming number of our population is functionally illiterate. At this level, people may struggle to read a bus schedule, medicine bottle or job application which highly impairs their ability to function in society. In this literature review, I look at why literacy is important to function in society and the factors that contribute to becoming functionally literate. This literature review compiles relevant literature that examines the home literacy environment and how that influences young children’s ability to learn. Evidence shows that by improving aspects of the home literacy environment such as having more children’s books in the home, more frequent storytelling, and more frequent shared book reading in a week all help to improve children’s vocabulary and decoding skills which are both fundamental to literacy. With this article I hope to deepen understanding of literacy and the home literacy environment which will lead to a more literate society.
Abstract

I am working with a hypothetical manned space vehicle in which there are two solar arrays that can provide power and two batteries that can store excess power from the solar arrays and provide power as needed. As these four power sources are turned on and off, ‘islands’ are formed as different parts of the grid are energized or deenergized. My goal is to formulate a mixed integer programming problem that can manage the load scaling of these islands as well as adapt in the event that something goes awry. This includes taking into account not just the current optimal layout but future optimal layouts as well and prioritizing critical functions such as life support systems over lesser functions such as exercise equipment.
### Abstract

The difference between discrete and continuous fuel is the state of homogeneity the fuel exhibits. Discrete fuel is considered to be non-homogeneous whereas continuous fuel is homogeneous in nature. A good example of a continuous fuel would be a piece of paper. Some examples of a discrete fuel would be urban buildings, forest trees, or pieces of paper separated from each other at a certain distance. It has been demonstrated in previous studies that a flame will spread faster across an array of discrete fuel samples as opposed to continuous samples. Due to the difference in fire spread rates across discrete and continuous samples and how quickly potential damages could ensue from igniting discrete versus continuous fuel, it is important to gain an improved understanding of the behavior of each fuel type. In this study, the behavior of upward flame spread has been tested and examined by igniting discrete and continuous fuel samples in a vertical array.

Each discrete sample set analyzed in this study contained filter paper fuel samples with a length of 1cm and fuel gaps between each sample with a range of 1-10cm in length. The difference in behavior of the flame spread across each discrete and continuous sample set was examined by collecting parametric data to study the position of the flame base versus time. Green LED lights were used in this process to improve the ability to track the pyrolysis of the filter paper with video recorded data. Matlab was also used to analyze and quantify the visual data obtained. As a result of this data collection, it is an expectation to discover the fuel gap length at which the flame can no longer travel to the next consecutive fuel sample because the gap size is too large. The data should also provide evidence that as the fuel gap size increases and approaches the fuel gap length limit, the rate of flame spread across the fuel samples will increase as well.
Glioblastoma (GBM) is the most prevalent and aggressive brain tumors. The GBM tumor is composed of different populations of cancer stem cells and differentiated cells. The cancer stem cells are resistant to chemo and radiation therapy, making GBM very hard to destroy. These cancer stem cells have a protein called connexin 46 that is exclusively found in the stem cells and are important in cell-cell communication. Targeting and inhibiting connexin 46 function, and thus cell-cell communication is regulated by a group of proteins called connexins. Connexins are able to form hexamers that create a pore in the cell membrane, called a hemichannel. When two hemichannels from two different cells are coupled they form a gap junction. These gap junctions allow cells to share molecules and are vital to maintaining homeostasis and synchronizing the activities of cells. Connexin 46 is found exclusively in GBM and high levels of it have been correlated with worse patient prognoses. Therefore, targeting and inhibiting connexin 46 in hemichannel and gap junction function in CSCs could prove to be a novel therapy in GBM. To determine the role of connexin 46 in CSC self-renewal, various point mutations that are known to reduce or enhance gap junction or hemichannel function were created and introduced into cancer stem cells through nucleofection. Cyquant cell proliferation, caspase cell death and limiting dilution assays were performed to assess self-renewal and cell proliferation. Time-lapse videos were used to visualize hemichannel and gap junction function to determine the activity level of both.
Short interfering RNA (siRNA) can regulate many biological processes via post-transcriptional gene inhibition, but spatiotemporal control of its delivery remains a challenge. In this work, a dual-crosslinked, photodegradable hydrogel was engineered to permit UV-controlled release of nanoparticles formed via ionic complexation of siRNA and polyethyleneimine (PEI). To demonstrate the system’s potential utility, siNoggin released by UV application was shown to induce osteogenic differentiation of human mesenchymal stem cells (hMSCs). Poly(ethylene glycol)-di(photolabile acrylate) (PEG-DPA) was synthesized and reacted with 8-arm-PEG-SH at a thiol/acylate ratio of 4, and then H2O2 (1 µL, 5% in water) was added to crosslink the unreacted thiol groups. siRNA was complexed with PEI and encapsulated into the hydrogels. UV was applied at an intensity of 2 mW/cm^2 for 10 min, and the released siRNA was analyzed using a Ribogreen assay. To examine bioactivity of released siGFP (green fluorescent protein), destabilized GFP (deGFP)-expressing HeLa cells were treated with releasates and cultured for 48 h, and GFP expression was analyzed using a flow cytometer. The ability of released siNoggin to induce osteogenic differentiation of hMSCs cultured in osteogenic media in monolayer was examined by staining treated cells for calcium with Alizarin S red after 3 wks. Over 18 days, UV exposure was demonstrated to increase cumulative siRNA release by 49.2± 9.5%, and attributed to the photolysis of photodegradable groups and resulting hydrogel degradation. Released siGFP actively inhibited GFP expression of HeLa cells, indicating that the UV dose applied to the hydrogels minimally affects siRNA bioactivity. Released siNoggin increased osteogenic differentiation of hMSCs cultured in monolayer compared to no siRNA or non-targeting siRNA groups as evidenced by increased Alizarin S red staining intensity, indicating that the biomaterial may be applied to regulate regenerative processes.
Atop the roof of the Glennnan Engineering Building is the W8EDU station, home to the Case Amateur Radio Club. Our team’s goal is to develop an Earth-Moon-Earth (EME) communications receiver. This project will utilize the W8EDU station’s unused 2m antenna so that we will be able to receive signals sent out during EME contests. This will enhance the capabilities of the existing W8EDU station for both educational and experimental purposes. As there are no EME setups available on the market, we have to design and build our station based on references – modified to suit our needs.

This project is a continuation of a project we began last semester. As such, the main goal for this semester is to design, build, and test the individual components required of the EME receiving function. Required components are the: low noise amplifier with a bias-T and power supply. If this project is continued in the future, designing and developing the transmitting function will be the next big step.

We would like to acknowledge Case Amateur Radio Club for allowing us to modify the W8EDU station and for partnering with us and our advisor for his RF expertise and continued guidance.
## Abstract

Mini-Whegs are small robots designed to traverse difficult terrain in a way that a robot with traditional wheels cannot, which can be attributed to their spoked appendages known as wheel-legs. The unique geometry of the wheel-legs causes excessive vibrations, which creates disturbances in picture quality if a camera is mounted on the robot. Different wheel-leg designs were analyzed and evaluated in order to discover the optimal geometry for minimizing vibrations in the robot. 3D printed prototypes were created in order to test stiffness, damping, motion and force in the wheel-legs to decrease vibrations. A high speed camera was used to evaluate displacement of the center of mass and other points of interest on the robot in order to evaluate motion while the robot was running on a treadmill. Force was evaluated with a force plate and strain gage in order to determine the force that each wheel-leg exerts on the ground. The stiffness was measured by supporting the wheel-leg on a balance, applying a force, and using a scale to measure the deflection of wheel-leg. The results obtained from these empirical test were then used in a MATLAB vibration simulation to compare results for different wheel-leg geometries and determine the optimal wheel-leg design for onboard camera usage. It was determined that the stability of wheel-leg is directly proportional to the number of spokes and stiffer spokes provided less vertical displacement, while less stiff spokes provided less angular displacements.
Optimizing Advanced Stimulation Paradigms to Improve Performance of Functional Neuromuscular Stimulation

Functional neuromuscular stimulation (FNS) is used to improve the lives of people living with spinal cord injuries. In motor system neuroprostheses, FNS consists of multiple channels of electrical stimulation on peripheral nerves to produce controlled muscle contractions and generate useful movements of paralyzed limbs. Current FNS systems that enable standing require high levels of constant stimulation. In human studies, high levels of constant stimulation cause early onset fatigue. To accommodate the needs of prolonged standing, more sophisticated advanced stimulation paradigms (ASPs) activate altering combinations of several muscles that have the same desired function. Each muscle is activated at less than full strength and the intensity of muscle activation varies over time. The objective of an ASP is to balance the shifting activation of muscle combinations such that the resulting total output is constant. Examples of ASPs include carousel, interleaved, and sum-of phase-shifted sinusoids (SOPS). Preliminary data from two human subjects shows the SOPS paradigm provides an increase in time to fatigue compared to constant stimulation (13.8 vs. 2.3 minutes and 9.5 vs. 4.2 minutes for subjects 1 and 2, respectively). Proper balance of the ASP parameters currently requires time-consuming manual tuning. We are developing an automated tuning method in felines. Three cats were implanted bilaterally with 16-channel C-FINE electrodes on the sciatic nerve. A JR3 moment transducer measures the ankle moment produced from stimulation of individual and multiple channels. Automated computational algorithms developed in this study should optimize performance of ASPs to delay the onset of fatigue in human subjects.
At 1, 5, and 10 minutes post-birth, all newborns are assessed for wellbeing by conducting the gold standard APGAR scoring technique, which evaluates the infant’s color, heart rate, muscle tone, reflex irritability and respiratory effort. In order to achieve an acceptable APGAR score and be considered viable, a newborn must be crying lustily and moving all extremities. However, when placed in skin-to-skin contact with the mother, the infant exhibits parasympathetic responses, such as no crying, no extremity movements, and easy breathing. Therefore, the APGAR scoring tool was thought to be inappropriate in the context of contemporary skin-to-skin contact with the mother in the first ten minutes of life. Prior to adjusting APGAR scoring or creating a new method of scoring, description of healthy term newborn heart rates, breathing rates, and behaviors at 1, 5, and 10 minutes post-birth is needed. A descriptive study was designed to describe nurses’ scoring of newborns’ 1, 5, and 10 minute APGAR scores while being held in skin-to-skin contact with the mother in the delivery room of Elyria Medical Center Hospital in Elyria, OH. Each delivery was videotaped and the APGAR scores were related to the researcher who conducted the videotaping and to the researcher who recorded the nurse’s data and directly observed newborn behaviors using a checklist. By videotaping and having direct observation, the accuracy of the nurses’ scoring of the APGARs as well as the suitability of using the traditional APGAR score to describe wellbeing of newborns being held skin-to-skin, chest-to-chest (SSC), can be verified by infant behavior. This study is ongoing, and currently only heart rate and pulse oximetry data at 1, 5, and 10 minutes have been reported. Full data, including respiratory rates and behaviors at 1, 5, and 10 minutes post-birth are needed to draw conclusive results from this study.
Synthesizing polymers with new backbones opens new opportunities for unique and useful polymer applications. This presentation describes a synthetic method used for initiation of polymerization of triethyl silyl ketenes. Silyl ketenes are new monomers that have only recently been considered for polymerization. Here, triethyl silyl ketene is used as the specific monomer. Trimethyl silyl triflate is used as an initiator to produce a cation which will allow for future polymerization. The trimethyl silyl triflate is believed to coordinate to the oxygen on the silyl ketene creating a positively charged resonance structure which can in turn promote polymerization. This reaction is monitored with FTIR and NMR to confirm the prediction.
According to the CDC, stroke is a leading cause of serious long-term disability, affecting more than 795,000 people in the United States each year. Current models to assist patients in rehabilitation after stroke include therapy with healthcare professionals including physical therapists, occupational therapists, and speech-language pathologists. While their care is unique and beneficial, music therapists are currently much less involved and are rarely even included on a stroke patient's rehabilitation team. This project utilizes different platforms to develop a model for the cooperation of music therapists and speech-language pathologists in the co-treatment of patients. A music therapist and a speech-language pathologist were interviewed and observed in a post-stroke treatment group, and scholarly research articles were reviewed. Results reveal that there are few studies of co-treatments available, and a model has been developed as a framework for co-treatments between music therapists and speech-language pathologists.
Earthworms move through the use of peristaltic motion, a system of locomotion where multiple body segments expand and contract in a wave like pattern to move. The study of worms their motion has led to building robots that are able to move in a similar wave like form. Through the past several years there have been three iterations of robots that utilize this form of movement to move along flat ground and pipes. The goal for future iterations of robots is to allow them to function autonomously. A network of force sensitive resistors will allow it to sense pipe diameters or objects coming in contact with it. The goal is to improve upon the detection speed and accuracy of the current method of slack detection. This research will explain the current understanding of how many pressure sensors are needed per segment and where the pressure sensors should be located along the robot as well as compare the sensor effectiveness in detecting pipe diameters to the current method. The end result of this project is a sensor system capable of being implemented on different past and future iterations of the robots that can work together to provide the worm robot with information on its surroundings and movement.
Lead poisoning is an insidious problem that has still not been eradicated. While recent media attention has focused on Flint, Michigan, Cleveland has even higher levels of lead poisoning. Environmental racism is a pertinent concern when one considers which neighborhoods are most impacted by lead. This paper seeks to examine different sources of lead poisoning, the environmental justice and health disparities in who bears the brunt of the lead poisoning, and what can be done to combat this. Case studies and best practices from other cities were analyzed as well as relevant policy changes taken to combat lead’s prevalence. Recommendations were produced in order to take a systematic, research-backed approach to the lead crisis in Cleveland.
The Rorschach inkblot test was still in its early stages of development when Hermann Rorschach passed away. Published in 1921, the Rorschach inkblot test was used commonly as a psychological test. Though it was widely accepted, there was still controversy surrounding the test. Due to the different ways of scoring responses, it was often stated that they could be considered completely separate tests. For a variety of reasons, society has created its own myths about the Rorschach; namely, that it is used to diagnose mental disorders. In order to examine the ways in which the Rorschach is valid in evaluating patients, it is important to look at the previous research that has been done on the topic. The Rorschach without a doubt has played an important role in the world of psychology, just not necessarily in the way that most believe that it has.
As fossil fuel consumption and environmental sustainability become increasingly important in our world, energy conservation is an issue that must be brought to the forefront. The purpose of this project is to monitor and reduce energy consumption in two buildings on the campus of Case Western through the use of “transactive control”. This is a technique that allows users to communicate with physical devices within a building in order to reduce the magnitude and cost of energy it uses. A crucial step in achieving this capability is constructing an energy model of the building that gives insight on its energy consumption – where, when, and what is using the most energy. While this Building-To-Grid Integration Project is an extremely complex and cross-functional task, my focus will be on the mechanical engineering aspects, particularly the energy modeling of Olin building. DesignBuilder software was used to construct the model of the building and define parameters such as wall, roof, and window materials, HVAC zones, lighting, occupancy, shadowing, and more. Then, the building model was imported into EnergyPlus, an energy simulation software developed by the United States Department of Energy. EnergyPlus uses the DesignBuilder file and local weather data to simulate a desired period of time and output data and graphs about the building’s energy consumption. This information will be analyzed to determine different methods of reducing energy usage, such as changing heating and cooling set points, ventilation settings, or plug load schedules, which can be communicated to the building system through a program called VOLTTRON. The effects of this project will mean large energy and cost savings for Olin and White buildings at CWRU. If it is successful, it will be a huge step in the right direction for Case’s Climate Action Plan as well as for the concepts of transactive control and “smart” buildings, which could play a vital role on the route to a more sustainable future.
Harmonizr is a unique music analysis platform that lets users create intentionally ordered playlists with their own music. No longer should a party host be content with the shuffle function or a "curated" playlist using song choices made by an algorithm. Each song in Harmonizr's catalog will be analyzed using Essentia, a music analysis library written by the Music Technology Group at Pompeu Fabra University in Barcelona. The user selects their song choices from a database of analyzed music, or uploads their own music if it is not already present there. Harmonizr will then algorithmically sort the music into a party-friendly pattern, saving the higher energy music for a time of the user's choice. The ordered playlist created by Harmonizr will then be exported to the user's PC or directly to their Spotify account.
When alcohol is consumed during early pregnancy, abnormalities in the embryo and the fetus may result from abnormalities of neural crest cell biology. The consequences, Fetal Alcohol Syndrome (FAS), persist as a major problem worldwide. The hypothesis tested is if alcohol damages neural crest cells, then their derivatives, the autonomic nervous system and smooth muscle cells around some coronary vessels, would develop abnormally. This may lead to arrhythmias and coronary anomalies that could impact morbidity and mortality. Quail eggs were injected with alcohol to mimic a session of binge drinking early in pregnancy. The control eggs were injected with saline. Both sets were incubated until embryos would normally form four chambered hearts with coronaries and autonomic innervation. The ethanol-exposed embryos had a 58.3% survival rate, while 83.3% of the control embryos survived. This data matches the survival rates of our previous experiments. To visualize cardiac innervation, hearts from surviving embryos were permeabilized with detergent, and an immunostaining technique was used to fluorescently label neuron-specific tubulin (TUJ1). TUJ1stained nerves of ethanol-exposed embryos covered a smaller area of the heart surface and branched with more acute angles compared to hearts of control embryos. A novel technique, SLIME (Scatter labeled imaging of microvasculature in excised tissue) was used to detect coronaries. SLIME, a titanium-containing colloid solution, was injected into the aorta while vessels were visualized with optical coherence tomography during the filling of the coronaries. The sequence of vessel filling was atypical in ethanol-exposed quail embryos, indicating abnormal connections of the coronary vasculature. The results suggest that early ethanol exposure mimicking early binge drinking during pregnancy leads to abnormal autonomic innervation and coronaries.
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**Title**: A case study on co-speech gesture in the clinical setting for its potential of being a target for communication training for physicians

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**Elevator Speech**: Training physicians to make use of all modes of communication could enhance the quality of conversations occurring in the doctor-patient setting. Co-speech gesture is an understudied area in the clinical setting and teaching physicians to utilize it may increase patient outcomes.

**Key Words**: Gesture  
**Training**  
**Physician**

**Abstract**

The few attempted communications interventions for clinicians in the doctor-patient setting have had positive effects on patient outcome. While most research and training focuses on verbal communication tactics, little work has been done on non-verbal communication. Many methods have been proposed to measure non-verbal communication in the doctor-patient setting, but little has been done that focuses specifically on co-speech gesture. This case study looks at abstract and concrete gestures, as defined in the cognitive science setting, and how they change during a discussion between a doctor and patient. We looked at a small collection of doctor-patient conversations and tracked abstract and concrete gestures by doctors and patients to identify shifts between gesture-type by both individuals through the exchange.
The team refurbished and expanded upon a non-functioning educational solar tracker system at the Lake Metroparks Farmpark. The installation exhibits solar harvesting through an interactive display and pump system, which demonstrates solar energy collection through proportional pump output. Using a Rockwell Automation controller and a Raspberry Pi 3 for control and display driving, visitors can see real-time panel statistics on a touchscreen, and move the panel on two axes using a joystick. As users move the solar panel, they will be able to observe the height of a fountain vary proportionally to the incoming solar power collection. Joystick movement also opens and closes solenoid valves relative to its position, controlling flow through additional water spigots. Additionally, an audio component uses ChucK, a strongly-timed, concurrent, and on-the-fly music programming language to sonify solar panel energy data. This creates a musical expression of energy collection through proportionally manipulating musical characteristics such as pitch, tempo, dynamic, and subdivision. Lastly, there will be a demonstration of how batteries charge and drain through the inclusion of a solar-powered charging station. From this station, users will have a visual representation of how the array powers the charging battery and how their device drains the battery as it charges.
The Energy Information Dashboard (EIDA™) is an electrical market simulation web application made to allow students to gain experience with how energy generation and its wholesale market interact. EIDA™ will be offered not only to students, but also to electrical engineers that need to take courses to renew their licenses. Through the simulator, the user will ultimately be able to manage several generators for different types of energy, determining how much energy the generator will produce. They will then be able to sell and buy electricity on a primary and secondary market in order to meet customer need and maximize profit. The user will need to take into consideration several factors while managing the generators, such as weather, energy production costs and the risk involved in each individual energy market.

At this time, simulations can only include one generator, as this project is part of a multi-semester effort, and emphasis has been placed on improving craftsmanship, testing, and documentation of back-end features.
It is the purpose of this project to develop a device that can measure the ripeness of fruit. Current fruit ripeness tests involve penetrating the skin of a fruit to determine firmness, effectively destroying the selected fruit. This is useful for fruit vendors when determining the ripeness of a large batch, but useless for the end consumer. It is possible to determine ripeness acoustically or via light wavelength (color) measurements, but these non-destructive methods come with great financial cost. Consumers are left to squeeze fruits by hand at the store, guessing at the level of ripeness. The objective of this project is to design and build a cost-effective, non-destructive, handheld fruit ripeness-testing device for hand-sized fruits. Deliverables resulting from this project include the development of a working prototype that measures stiffness non-destructively, and stiffness data collected from experimental tests with the prototype on avocados. Stiffness will be determined by analyzing force vs. displacement. Force is measured by pressing an avocado against an Adafruit force-sensitive resistor, and displacement in the avocado is measured by a linear potentiometer position sensor. Avocados are tested every 6 hours in a controlled environment away from other fruit to control the ripening process. Stiffness is an indication of ripeness, and optimal ripeness is determined by a testing panel that is introduced avocados at various levels of stiffness for consumption. Key qualitative criteria for optimum ripeness are taste and texture. By analyzing the stiffness data for avocados over time, it is possible to estimate the time until optimum ripeness from a single stiffness measurement.
Admixtures are chemicals added to concrete to alter its properties. One category of admixtures are color admixtures, which serve to color concrete for high-profile projects that require pleasing aesthetics. The customer’s current color admixture dispensing system presents several difficulties including a high capital cost and frequent maintenance. Additionally, the admixture dispensing process is extremely time sensitive because of the fast concrete curing rate; therefore, the relatively slow loading time of the current system is a drawback. The goal of this project is to design a new color admixture dispensing system that addresses these issues. Multiple designs were developed, each focused on solving one or more of the stated problems. The most favorable design successfully addresses all issues. Capital cost is reduced by 25%, less maintenance is required, and the time required to load the color admixture into the concrete mixer is reduced. These benefits are achieved by replacing the existing peristaltic pumps with much cheaper and easier to maintain pumps. Additionally, the finer control advantage of the peristaltic pumps is replicated in the new design by installing appropriate valves to control color flow rate. Finally, the system pre-loads the color into a separate container, minimizing the time required for discharge into the concrete mixer.
During my position at Battelle, I was able to work on electromagnetic compatibility (EMC) testing; device prototype builds; circuit rework; speaker/buzzer selection and design based on usability standards and user research; Bluetooth signal strength testing and data analysis in MATLAB; circuit board layout in Allegro; part research and selection for detection switches; environmental test plan development from relevant standards specifications; and controlled voltage line signal analysis with oscilloscopes. I learned a lot from my co-op about electrical hardware engineering and the research and development process. I was able to sharpen my skills in EMC, which is a very important area of electrical engineering that evaluates how much noise an electronic product produces and how well it is immune to types of electrical noise. At Battelle, I was very involved in three types of EMC immunity tests: Electrical Fast Transients (EFT), Electrostatic Discharge (ESD), and Surge. All three test the electronic product’s ability to handle different types of electrical noise.

Electrical fast transients are high frequency noise produced with the switching of inductive loads. Electrostatic discharge occurs when accumulated charge on a surface discharges to a product. Surge is low frequency high power noise. All three of these tests and the specific timing and voltage levels are outlined in specific test standards. The purpose of the testing is to evaluate your product’s ability to perform as intended during the stress of these testing conditions. During my testing, the product failed electrical fast transient testing twice and software modifications had to be made to ignore the noise. The product was able to show compliance to these standards, which proves that the product can safely be operated even when exposed to these types of noise.
Many people believe that happiness is derived from external sources, such as money or beauty. This myth is perpetuated, among other sources, by the many advertisements we see each day telling us we need a certain beauty product or weight loss pill to be happy. However, there is a significant amount of research available that provides evidence against the claim that the best sources of happiness are external. Although people can certainly derive some happiness from external factors, research suggests that these are not the only components involved and, actually, internal sources of happiness are much stronger. In addition, biological factors or even certain microbes in our guts can be strong contributors to our general levels of happiness. Determining what truly makes us happy and, perhaps, learning to accept the factors we cannot control is an important step toward finding the happiness we all seek.
Identifying Mechanisms of Resistance to Protein Phosphatase 2A (PP2A) Activation

Cancer is a disease involving abnormal cell growth that claims millions of lives across the world on an annual basis. This abnormal cell growth is highly due to an imbalance between proteins that drive cellular division, or oncogenes, and proteins that prevent it, or tumor suppressors. One of the tumor suppressors that is commonly inactive in cancer cells is protein phosphatase 2A (PP2A), which dephosphorylates several major oncogenic signaling cascades. Its inactivation results in sustainable activation of oncogenic RAS/MAPK/MEK/ERK and PI3K/AKT pathways. The Narla laboratory has developed a series of Small Molecules Activators of PP2A (SMAP) that downregulate the oncogenic pathways aforementioned by reactivating PP2A and hence, inducing tumor growth inhibition. Since mutations at the drug binding site is a common resistance mechanism to targeted therapy, it was hypothesized that mutating the SMAP binding sites on PP2A would desensitize the tumor to SMAP treatment and abrogate the anti-cancer effect of the SMAPs. After identifying K194, E197, and L198 as the putative binding amino acids of SMAP on the PP2A-A? subunit, those amino acids were mutated and introduced into the lung adenocarcinoma H358 cell line. The H358 isogenic cell lines with the different mutations were injected into mice and treated with either vehicle control, or DT-061, a SMAP derivative. It was observed that tumors harboring K194R and L198V mutations were resistant to SMAP treatment. These results suggest that SMAP binds at residues K194 and L198 of PP2A.

Identifying the potential mechanisms of resistance to PP2A activation will help guide the synthesis of second generation SMAP derivatives. Furthermore, our results will shed more light on rational drug combinations to delay drug resistance, and help determine target specificity for the drug.
Ninety percent of all people are exposed to a traumatic event at some point in their lives. Up to 20% of those people go on to develop some form of post traumatic stress disorder (PTSD), often arising from a combination of genetic predisposition, the traumatic memory, and the consolidation of that memory. Despite the vast research done on PTSD, little has been found regarding how to effectively treat those dealing with PTSD. While drugs have been prescribed to treat these disorders, most antidepressants are not effective and come with a plethora of side effects. However, by looking at the practical applications of memory modulation in combination with specific drugs, it is possible to give those afflicted a treatment plan focusing on erasing those traumatic memories and the symptoms that come with them. The use of propranolol and other medicines offer us a chance to combat disorders dealing with traumatic memories by interfering with the consolidation and long term potentiation process.
Author Status  | Case Western Reserve University
Author Affiliation  | Case Western Reserve University
Published?  | True
Elevator Speech

In Dr. Kash’s group, we are working to find the next material that can potentially be used innovate current semiconductor technology, branching off of the Nobel Prize Winner in Physics (2014). I am adding to this mission by collecting and comparing photoluminescence data of new materials to further our understanding of their optical and electrical properties.

Key Words
Photoluminescence
Spectroscopy

Abstract
We have done photoluminescence measurements on Gallium Nitride, GaN, samples at different temperatures and excitation intensities. Comparisons of these photoluminescence spectra give information on how electrons are trapped by defects and whether peaks in the spectra are related to the band gap or to defects for these GaN samples. In order to conduct these measurements, Dr. Kash and I put together a photon counting spectrometer measurement system. The instrument is capable of measuring spectra from 300 - 890 nm wavelengths. We find that the conduction band to valence band recombination increases as you lower the temperature or increase the excitation intensity while radiative defect recombination exhibits the opposite behavior.
Collapsible, Portable Fly Fishing Net

Elevator Speech
Being able to collapse from almost 3’ to only 1’ with a lightweight aluminum frame, this new landing net design will allow anglers to more easily access their net while fishing as well as being more convenient to transport.

Key Words
Landing Net
Portable
Collapsible

Abstract
This project centers around designing a compact, lightweight, collapsible fly-fishing net for Incentra Inc. This new design is necessary so that landing nets can be easier to carry and use. The final design must have a net opening of at least 12 inches by 24 inches, have a net depth of at least 18 inches, be able to hold a 36 inch fish that weighs 20 pounds, be able to float if dropped in water, and be able to be sold at a retail price of $250. To begin, several different collapse methods were researched with the net design in mind. The collapse methods involved telescoping, folding, and pull-apart components. Next, multiple designs were created in Solidworks that utilized these collapse methods and analysis was conducted on each of them. After consulting with Incentra Inc., a final design was picked based on ease of manufacturability, ease of use, and aesthetic appeal. This final design utilizes a telescoping method along with two hinges. This design allows for a compact collapsed form about 12 inches in length, is able to be opened with just one hand, and has a safety factor of 13. For the frame, 6061-T6 aluminum will be used based on its high strength, low weight, corrosion resistant properties, and cost/manufacturability. For the net, the different materials researched were nylon, rubber, and rubber coated nylon. Rubber coated nylon was chosen based on its flexibility and harmlessness to the fish. The net will be attached to the frame by metal rings that are free to slide along the length of the frame. After all design decisions were completed, a proof of concept prototype was made out of PVC while establishing a method for manufacturing and a plan for marketing the final product.
The A.R.C.S. stands for autonomous robot with crab-like steering. This is a continuation of a previous EMAE 398 project. The previous robot implemented the same steering system but only capable of following drawn lines. The objective is to fully design and manufacture an operational robot with obstacle avoidance and GPS capabilities that can operate outside. The final design must be capable of reaching a designated endpoint autonomously with no assistance from manual control inputs. In the final test run, obstructions will be intentionally placed in the robot's path that it must be able to avoid entirely based on its obstacle avoidance programming. The robot will detect obstacles using laser proximity sensors mounted on the front and sides of it. Depending on which sensor detects an obstacle, the robot will turn 90 degrees, clear the obstacle, turn back 90 degrees and continue on its way. It will continue this until its GPS receiver detects that it reached its destination. The deliverable to show that the objective has been completed is a video taken from atop the robot during its operation. The material selection and design modifications made are intended to strengthen the robot's structural integrity overall while reusing complex hardware such as motors and controllers. Additional hardware and software capabilities will be mounted to the improved chassis, including raspberry pie, motor controllers, and motors from the previous design, as well as the new laser proximity sensors, GPS, and an additional Arduino. We are also switching our programming language from Python to MATLAB and Simulink to create a better flow of our logic and better control our variables in a language we are more familiar with. These modifications take into account critical changes in material selection and component interactions, creating a steadier flow of the electrical components within the robot. A.R.C.S. should accomplish its objectives and a video of its performance will be shown.
Best Methodological Approach to Niche Modeling of Rhododendron

Hyun Jo Kim, Department of Biology; Jean H. Burns, Department of Biology

Niche modeling methods have improved rapidly over the last decade within the field of basic and applied ecology as one of the most significant tools in forecasting the effects of various ecological changes. Because different aspects of the environment such as climate change, dispersal, and evolution all shape a niche in complex, interconnected ways, many studies have tried to focus solely on one ecological impact, in order to ensure a reasonable methodological approach to niche modeling. In this experiment, a case study in Rhododendron was developed because this genus has 900 species that have evolved diverse niche strategies. Because Rhododendron is a widely ranging endemic across the globe, climate is one of the most dominant ecological factor in its species distribution. As such, climate was selected as the predictor of our interest. The central focus of this study was to analyze the methodological approaches to niche modeling published in previous studies of Rhododendron. The different methods in question were carefully reviewed and compared, in order to determine the best methodological approach to niche modeling in the case of Rhododendron. The methodological approaches reported in this study were divided into two categories: correlative and mechanistic. Among the methods studied, fixed geographic domain approach is most suitable for Rhododendron because this method is appropriate for species that has a diverse niche such as our endemic. Therefore, in this study, fixed geographic domain approach is proposed as the best method.

Project Mentor: Dr. Jean H. Burns, Department of Biology
This life story project examines the lived experiences of professional dancers of color. There is a gap in the literature for professional dancers of color, their voices, and their experiences. They are underrepresented within professional ballet, contemporary, and modern dance companies and have faced documented racial discrimination. It is imperative that we understand the how and why of this racial underrepresentation. Oral histories or life histories are a method of qualitative, empirical data collection that provide the opportunity for the participant to use their own voice to narrate their experiences and acknowledge the power differential that frequently occurs between researcher and participant. My study was conducted from September 2016 to December 2016. I received IRB approval in early October and recruited two participants. I conducted two in-person open ended interviews with each participant, each interview lasting between 1-2 hours. After conducting the interviews, I transcribed the audio recording and used grounded theory to engage in line-by-line coding. Several themes emerged from the analysis and legitimacy theory helped frame these concepts within the larger American capitalist society. To my knowledge, no life histories of professional dancers of color exist. This study aims to fill this gap in the academy. By further understanding these dancers’ experiences, we can better understand the raced hierarchies in the dance world.
Veterans with prediabetes enroll in Diabetes Self-Management Education (DSME) to learn skills, knowledge and ability to make lifestyle changes to prevent diabetes onset. PURPOSE Evaluate goal setting/behavior change impact on body weight (BW kg), Hb A1C (A1C%) and systolic blood pressure in Veterans with prediabetes. DSME allow Veterans to gain skills, knowledge, and ability to make lifestyle changes to prevent diabetes onset. Our results indicated that behavior changes and goal setting were not associated with changes in the biomarkers used. Through t
Abstract

Limited visualization of semi-transparent tissue layers in the eye during surgical interventions for ocular diseases is a critical barrier to developing novel surgical techniques and improving clinical outcomes. We addressed limitations in image-guided ophthalmic microsurgery by using microscope-integrated multimodal intraoperative swept-source spectrally encoded scanning laser ophthalmoscopy and optical coherence tomography (iSS-SESLO-OCT).

We demonstrate simultaneous acquisition of en face SESLO images which enabled orientation and co-registration with the widefield surgical microscope view with every OCT cross-section which enabled depth-resolved visualization of surgical instrument positions relative to anatomic structures-of-interest using our new 400 kHz iSS-SESLO-OCT. Integration with a surgical microscope and TrueVision stereoscopic viewing system allowed for side-by-side viewing of the surgical field with SESLO and OCT previews for real-time feedback. We also demonstrated novel integrated segmentation overlays for augmented -reality surgical guidance. In vivo human imaging performance was demonstrated on a healthy volunteer, and simulated surgical maneuvers were performed in ex vivo porcine eyes. Densely sampled volumes were used to visualize tissue deformations and surgical dynamics during corneal sweeps, compressions, and dissections, and retinal sweeps, compressions, and elevations. Integration of the different imaging modalities may benefit surgical outcomes by enabling real-time intraoperative visualization of surgical plans, instrument positions, tissue deformations, and image-based surrogate biomarkers correlated with completion of surgical goals.
Improving Medication Adherence in the HIV+ Population in the United States: A Literature Review

Abstract

Treatment for HIV has improved drastically in the last two decades, but controlling the virus still requires strict adherence to medication regimens. Adherence to HIV medications is vital for two reasons: it keeps HIV-positive patients healthy, and it significantly lowers the chances of spreading the virus to others. This literature review of research on HIV medication adherence was conducted to determine the current status of adherence, as well as determine the most effective methods of improving adherence. An electronic database search of PubMed and PsycINFO returned 17 articles that were found to meet inclusion criteria. The literature reviewed suggested that mindfulness training, cognitive-behavioral therapy, single-dose pill regimens, and technological aids all resulted in an increase in adherence. The sample size of many of the studies was relatively small, and more studies are needed to replicate these results. Future investigation is also needed on a longitudinal scale to determine the long-term effects of these interventions. Nevertheless, the articles reviewed in this paper showed promising signs of increasing adherence rates in the HIV+ population. The more that is learned about improving adherence to these life-saving medications, the healthier HIV+ patients will be and the better the virus can be contained, leading to a healthier population overall.
This project uses the Microsoft Kinect sensor to detect patient motion with an accuracy of 1 mm. The sensor is aimed at a target that is manually moved in the x and y directions. The depth of the object is measured as well. The data is collected by placing a rectangular and spherical target various distances from the sensor, moving the targets on grid paper in the x and y directions, and then recording the net displacements. The technologies used are the Microsoft Kinect sensor, Visual Studio 2015, and SDK 2.0 toolkit. The Kinect sensor is used to detect the target object. The main program is written in C# and executed using Visual Studio 2015. It calculates the net displacement as the object is moved. A user interface also displays an image of the target object in 2-D space. The goal of this project is to determine whether the rectangular or spherical target results in the greatest accuracy and least amount of error. Another goal is to determine the target position from the sensor that results in the most accurate displacement measurements. In the future, this research will provide a more affordable way for radiation technicians to detect patient movement and protect healthy tissue from radiation.
The purpose of this project is to create a multilayered and biaxially oriented high glass barrier film containing high aspect ratio and low Tg°C -- temperature where the glass transitions from a solid to a molten state. The importance of this project is that the these films have good oxygen blocking capabilities due to its polymeric structure compared to other gas barrier films seen in the food packaging industry. The main ingredients in the films are Tin Fluorophosphate Glass (Pglass) and Ethylene Vinyl Alcohol (EVOH). Pglass has a suitable Tg°C range allowing it to be paired with other organic polymers very easily, however, it doesn’t have good oxygen permeability. EVOH on the other hand is a great oxygen barrier film and pairing it with Pglass shows great potential. Permeability was tested between EVOH alone (control) and Pglass paired with EVOH. At 10% volume, 10% Pglass mixed with 90% EVOH, the film showed a higher permeability towards oxygen compared to EVOH alone. This shows that Pglass paired with EVOH has a lot of potential in being a high gas barrier film. The manufacturing cost is also cheaper compared to other commercial methods making this film a viable option in the future.
Abstract

Like all organisms living in seasonal environments, amphibians face time constraints. These time constraints, such as seasonal changes or desiccating habitats, have lead animals to evolve significant adaptive plasticities, relying strongly on seasonality cues to time critical life-history decisions such as when to initiate metamorphosis. Photoperiod is a complex, critical seasonality cue for many organisms. However, the effects of photoperiod as a seasonality cue in amphibians remains largely untested. In this experiment we tested hypotheses addressing the effects of photoperiod as a time constraint in fire-bellied toads (Bombina orientalis) as well as potential interaction effects with desiccating habitats. In a 3 x 2 factorial design, tadpoles were placed in light regimes simulating early, normal, and late larval development photoperiods in either a constant habitat or a desiccating habitat treatment. If tadpoles used photoperiod as a seasonality cue, we would expect that in the presence of light regimes simulating a late larval development photoperiod that metamorphosis would accelerate and the size at metamorphosis would be smaller as the tadpoles perceive a later season. Conversely, if later photoperiods act to afford more light and thus increase larval foraging time, the late photoperiod simulation should yield larger adults. By utilizing this experimental design, this will be one of the first studies to evaluate photoperiod as a time constraint in amphibian larval development.
Abstract

microRNAs have become prominent in cancer therapy due to their ability to regulate cancer-related genes through gene-translation. Specifically, miR-200c has become a popular therapeutic target in the treatment of triple negative breast cancer (TNBC) due to its role in suppressing metastasis, drug resistance and cancer stemness. However, the clinical application of miRNAs is limited by the lack of effective delivery methods. Here, we have optimized previously developed ECO, a cationic lipid carrier to facilitate the cytosolic release of miR-200c. Transfection was evaluated by analyzing respective mRNA and protein expressions of metastasis marker ZEB1 in TNBC cell lines MDA-MB-231 and Hs578Ts. ECO mediated delivery of miR-200c downregulated ZEB1 and BMI1 mRNA and protein levels. Additionally, decreased protein levels of drug efflux protein ABCG2 was observed, implicated miR-200c’s role in drug resistance. Functionally, the delivery of miR-200c in TNBC cells reduced cell survival as shown through the mRNA expression of cell survival proteins Cyclin D2 and Survivin. In addition, the migration of miR-200c treated cells was significantly reduced when compared to a negative control. The data not only points to the suppression of cancer stemness and metastasis, but also indicates a decreased ability for TNBC cells to survive upon delivery of miR-200c. Looking forward, the functional effects of miR-200c will be tested in vivo to evaluate treatment efficacy.
Fluorescence Studies of hnRNP A1 Interactions with the SLVI Domain of the Enterovirus 71 IRES

Abstract

Enterovirus 71 (EV71) is a positive single stranded RNA virus that infects young children. It is the main causative agent of neurovirulent Hand, Foot, and Mouth disease. Infection may lead to severe neurological and cardiovascular complications that may culminate in paralysis or death. Very little is understood about how the virus infects the host’s cells. To understand how the virus works on the molecular and structural level, we need to understand its interaction with other biomolecules during viral infection. To that end, the Stem Loop VI (SLVI) domain of the 5’ region of the virus and the UP1 domain of hnRNP A1 has been examined. During the early stage of infection, heterogeneous ribonucleoprotein A1 (hnRNP A1) promotes cap-independent translation of the RNA virus. SLVI is located in the Internal Ribosome Entry Site (IRES); the IRES allows the virus to initiate its own translation in a cap-independent manner. To better understand on how the UP1 domain of hnRNP A1 interacts with the upper hairpin loop of SLVI, Tyrosine fluorescence was used. Changes in the structural and/or chemical environment of tyrosine correlate with a change in fluorescence. Thus the binding of UP1 with the RNA should cause a change in fluorescence if they two biomolecules can interact. Data collected from this study has shown that titration of the upper hairpin loop of SLVI into UP1 domain of the hnRNP A1 results in a decrease in fluorescence indicating that RNA binding promotes changes in the tyrosine environment.
Retinoic acid (RA), a vitamin A metabolite, has the tendency to bind to the protein FABP5 rather than the protein PPAR?/? in certain cancers. The pathway of FABP5 causes cell proliferation and the pathway of PPAR?/? causes cell apoptosis. The goal of this research is to find a compound that will be a suitable replacement for RA that will bind to FABP5, which will then force RA to bind with PPAR?/? to promote cell proliferation, and thus becoming a natural cancer preventative. In order to find the substitution for RA, a binding assay and a viability assay has been performed with various compounds. The binding assay has shown the Kd (dissociation constant) for the different derivatives and FABP5. The chosen derivatives all contain a furan ring in the main structure. The derivatives with the furan ring did not show any significant change when moved along the backbone of the structure, but the derivatives with methyl groups added to the furan ring showed a drastic change in the results. With this significant change, more analyzation can lead to further understanding of the structure activity relationship. The viability assay was done with the same derivatives and the results showed the metabolic activity as well as the dose response of cancer cells with high levels of FABP5. In the future, more experimentation will be done with these compounds to better understand the structures suited for binding with FABP5.
Organized Crime is something that many people are familiar with, but don't often think about. Popular films like The Godfather, The Departed, and Taken extensively involve organized crime groups and their activities, giving the layman a window into the scene. However, even with this exposure, we often don’t think of the reality of such groups. In this literature review, I first give a short overview of different crime groups, their histories, and their activities around the world to ground the rest of the paper in reality. I then compile literature pertaining mostly to the global illegal cigarette trade run by crime groups, as well as some regarding other operations of organized crime groups. Better understanding of these groups and their activities is the only way in which we can hope to improve upon their effects on the world as we know it. Research into this field is comparatively sparse due to the difficulty of collecting data, however, I believe that now more than ever it is important to gain more insight into this topic.
Photodynamic Therapy to Treat Melanoma Using Fluorous Nanoparticle Carriers

Photodynamic therapy (PDT) is an adjuvant, non-invasive cancer treatment that is often limited by photosensitizer solubility and availability of oxygen in the tumor environment during treatment. This study describes the use of a water-dispersible fluorous polymer to deliver a small molecule photosensitizer with the goal of overcoming these limitations. Cellular uptake and efficiency were evaluated using models for squamous cell carcinoma and melanoma. The photosensitizer-conjugated fluorous polymer that showed uptake into both cancer cell lines and induced cell death when exposed to broad based white light, but was non-toxic otherwise. Taken together these results demonstrate that the fluorous polymer platform serves as an effective delivery system for a small molecule photosensitizer while increasing the generation of toxic reactive oxygen species.
A challenge for chemistry instructors is dealing with students' limited retention of concepts through core courses. Herein we present a novel bridge module encompassing refresher videos and active learning problem sets that tie together concepts from high-school and general chemistry, general and organic chemistry, and organic chemistry and biochemistry.
There is a belief a person’s style of handwriting is representative of their personality. Attempts have been made to use the belief in order to determine the personality of job candidates or solving crimes. This myth has been perpetuated by many media outlets, the general public, and at times academic professionals. Studies have been conducted to test the legitimacy of graphology, the analysis of handwriting, to see if results are accurately assisting employers or prosecutors in determining personality. While individuals have different writing styles the research from studies indicates that handwriting does not have a correlation to personality and consequently cannot be used to conclude an individual’s personality. Therefore using writing samples from individuals to predict and base an individual’s personality on would be inadequate. Graphology should not be used as a primary way to conclude a suspect’s involvement in crimes or a job candidate’s merit. Other methods should be studied to test a correlation to personality.
The objective of the research was to manipulate biomolecular signaling inside differentiating human mesenchymal stem cells (hMSCs) to improve properties of tissue engineered cartilage. Manipulation was achieved through Rho/ROCK signaling, a key biophysical signaling pathway that interferes with actin-myosin mediated contractile force generation and subsequent aggregation. The effect of the Rho/ROCK inhibition has not been investigated yet in hMSCs, which highlights the importance of this study.

Chondrogenesis is the process by which chondrocytes are formed from progenitor cells. Currently, small aggregates of scaffold-free cartilage constructs can be formed by subjecting hMSCs to culture medium containing growth factors. Aggregates are used primarily as an investigative tool due to their inferior properties compared to the native tissue.

While properties of hMSCs undergoing ROCK inhibition were not previously investigated, hMSCs have been observed to form a "loosely packed pellet". A loosely packed pellet of hMSCs can be linked to greater transport properties allowing for signaling molecules to permeate aggregates and improve conditions for cartilage tissue culture. While pellets being formed will not have the structure necessary for transport properties to be observed, they could be observed after seven days. As the extracellular matrix accumulates, the transport properties will be inhibited. Thus, ROCK inhibition was able to significantly enhance the transport properties from the less compact pellet structure. The central hypothesis is that modulation of transport properties via ROCK inhibition during chondrogenesis will lead to improved cartilage tissue. The resulting construct due to the ROCK signaling will lead to larger pellets, allowing the aggregates to be used as a more practical tool for clinical applications.
The political climate in the United States for the past few years has been a tense one. More than ever, the rift between the parties is growing, with individuals from both sides becoming more cemented in their beliefs. This phenomenon prompts several questions, one of them being: Political beliefs and cognitions have their roots in motivated social cognition. Since personality influences cognition and vice-versa, it seems likely that aspects of an individual's personality motivate political belief systems.

There have been key personality differences noted within political parties, but this paper will explore how personality relates to varying levels of liberalism or conservatism. One facet of personality that this paper will focus on is reverence for authority; it has also been linked to political beliefs (conservatism specifically), but this paper will attempt to further explore its link to the rise of the “alternative-right,” nationalist movement, including its role in modern-day anti-immigration and fascist sentiments. Self-esteem is another aspect of personality that will be explored. Past research has shown that self-esteem affects tendencies such as isolationism, which in turn affects attitudes towards immigration. The purpose of this paper is to explore, overall, how personality, reverence for authority, and self-esteem impact not just political beliefs, but also how they affect support for politicians who can be identified as nationalist demagogues.
Abstract

The traditional tools of the anthropologist have always been a pen and paper, used to write lengthy and exhaustive notes that would eventually make their way into an ethnography of some kind or be discarded. That said, anthropologists have a long history of using other methods of recording relevant cultural phenomena where words could not be descriptive enough, through photography, ethnographic sound recordings, and finally ethnographic film. These tools have aided in anthropological research and discovery and have been recognized as invaluable forms of data collection although each comes with a variety of problems both scientific and ethical. Many of these problems are unavoidable and must be accounted for to conduct honest research. As a combination of sound, photography, and literature film is especially subject to these problems. Thus the focus of this essay will be to expose the problems of using film for anthropological study and application as well as the immense potential that film carries for anthropological research.
Copper Intrauterine Device Utilizing Ni-Ti Shape Memory Alloy

The recent surge in IUD popularity among American women has lead to demand of a less painful alternative to conventional IUD options. We propose a copper based intrauterine device with a length of 1.1" that will use Ni-Ti shape memory alloy wires to allow for painless implantation and stability once inserted.

A free floating washer will be held onto a small rod by a cap at each end of the rod. The washer will be free to move along the body of the rod. Ni-Ti wires will be attached to the washer and one end of the rod. Before implantation the wires will be straight, so that the linear device will cause less pain upon implantation. After implantation the shape memory effect of the wires will be activated from the temperature of the body. The wires will bend away from the rod, changing the shape of the device to a sphere and holding it in place. To remove the device, tension will be applied to the trailing strings (a basic feature of commercial IUDs) subsequently collapsing the device into a compact, primarily linear form.
Schistosomiasis is a parasitic disease which affects about 240 million people worldwide and results in over 200 thousand deaths per year. Schistosomiasis is second only to malaria in terms of public health importance according to the WHO. Given the widespread impact of schistosomiasis combined with a genetic makeup that is complex and not well understood, it is critical to develop genetic tools in order to manipulate and to better understand schistosome biology. Stable expression of schistosome genes has proved challenging. We have previously transfected schistosome developmental stages with plasmids and measured various promoters for their ability to drive gene expression, however protein expression has been limited. Thus, this current work addresses the role of 3'-UTRs in the expression of genes as proteins. In order for stable expression of genes to proteins to occur, it is important for both the 3'-UTR as well as the 5'-UTR to function properly in conjunction. 3'-UTRS aid in stable protein expression by preventing mRNA degradation. This project tests whether myosin and profilin schistosome 3'-UTRs can impact protein expression in cos 7 cells.
According to the American Cancer Society, colon cancer is the third most common cancer worldwide and the second leading cause of cancer-induced mortality in the United States. There are more than 200,000 cases every year in the United States, and 49,190 deaths are expected to be caused by colon cancer in 2016 (American Cancer Society, 2015). The early stages of this disease consist of benign, adenomatous polyps, which produce few symptoms and can be detected through regular screenings and be effectively removed to treat the cancer. However, when these polyps develop into cancerous tumors, treatment becomes less simple and chances of survival drop. Our lab has previously demonstrated that diet-induced obesity caused intestinal inflammation, which contributed to the development and progression of colon cancer. High fat diets led to more rapid progression of tumors and elevated polyp incidence and mass, as compared to low fat diets, in B6.Apcmin/+ mice (Doerner 2013). Building on these studies, the focus of this paper is on uncovering the mechanism of the sex disparities of colon cancer development and examining the link between obesity, level of female sex hormones, and the development of intestinal tumors. By putting female B6.Apcmin/+ mice (mice that have been genetically manipulated to become prone to intestinal neoplasia) on either high fat or low fat diets and performing ovariectomies to vary estrogen levels between mice, we have found that mice with low estrogen levels and high BMIs developed more tumors than mice with high estrogen levels and low BMIs. This finding has the potential for application in detecting and treating colon cancer in the stages of noncancerous polyps through early screening for males, females with lower estrogen production ability, and obese individuals. This will lead to higher chances of survival for these patients.
Two competing talkers tend to cause decreases in speech recognition when at least one of the two talkers are perceptually similar to the target speaker. Data indicating this result, as well as data showing how each individual talker within the masker affects the overall masker effectiveness, will be presented.
Voice recognition software is becoming more popular due to the fact that this technology is becoming more accurate. Because of this, car manufactures are beginning to use this technology to allow drivers to give voice commands to the system computer. There are issues with the current systems employed, however, that must be overcome. With one microphone, it becomes very difficult to distinguish the driver's voice from other sounds within the vehicle - voice recognition software has a hard time achieving this. Some manufactures are using two microphones to implement beam-forming which is used to locate the driver's voice and other sounds in the vehicle in order to separate them. Using more microphones will allow for more accuracy in any beam-forming calculations, but strategic placement might allow for the use of less microphones. For example, if a microphone is the same distance from the driver and another passenger, it will not record either of their voices with high precision. This project will look into using multiple microphones in order to accomplish two things: reduce noise from white noise sources such as tire noise and wind; remove passenger voices from the driver's voice. If one microphone is used to record each passenger locally, this should provide the minimum number of microphones to remove passenger voices from the driver's commands with fair accuracy. An experiment using this technique to separate passenger voices and remove undesired voices from the driver's microphone is explored. Using more than one microphone to record each passenger will allow for a more accurate recording of that passenger by reducing local noise. This provides another experiment - how well white noise sources can reduced with multiple local microphones to a person's voice. Another goal of this project will be to produce a real-time, and thus efficient algorithm to reduce the necessary processing power.
The goal of the Resource Prospector mission, an ongoing project of the National Aeronautics and Space Administration, is to deploy a rover on the surface of the moon to harvest resources within the early 2020s. The rover will operate within the Permanently Shadowed Region of the moon where the ambient temperature is between 25-40 K. The tire must be compliant and have a nominal deflection of 20% of the wheel diameter from the weight of the rover. This project details the development of a compliant tire that can withstand the harsh cryogenic conditions to be expected.

The project’s intention is to identify and perform material testing on a selection of suitable alloys. The metals chosen will have face-centered cubic crystal lattices as they exhibit ductility even at cryogenic temperatures. The identified materials are SSA0188 aluminum alloy, 310 austenitic stainless steel, Ti-5Al-2.5Sn, and Nitinol. The modulus of elasticity and impact resistance are being tested at both room temperature, 77 K, and 40 K and the values are compared to those found in literature. In addition, the fatigue strength, specific heat capacity, thermal conductivity, and hardness are being determined from literature. In addition, the specific mechanical design of a compliant tire which can meet the desired requirements is identified. The design decision is based upon the tire’s deformability, strength (both yield and fatigue), and tractive performance.

The material will be implemented into a chosen compliant tire design selected and analysis of the forces over the rover’s life cycle are performed. The design is mathematically verified to perform as desired and is not susceptible to a singular point of failure. If time permits, a prototype will be created with the stiffness varied to match to the change in gravitational forces between the moon and the Earth. The prototype is analyzed for its tractive performance and life cycle.
Vitamin A, or retinol, is an essential nutrient that is stored in the liver. Retinol is a hydrophobic compound and requires retinol binding protein 4 (RBP4), a 21kDa protein that binds retinol in the blood. While the liver is the main site of synthesis of RBP4, as much as 20% is synthesized and secreted by adipose tissues; thus, RBP4 is considered an adipokine. Previous studies have linked RBP4 with reduced expression of the insulin-responsive glucose transporter, GLUT4. In humans, it was found that serum levels of RBP4 strongly correlated with insulin resistance, obesity, impaired glucose tolerance, as well as indicators of metabolic syndrome. RBP4 signaling clearly plays some role in insulin resistance, and its sequela, type 2 diabetes mellitus. Still work needs to be done to elucidate the interplay of diet, sex hormones, and RBP4. Herein, C57Bl/6J mice were set up in 8 groups: ovariectomized (OVX) high fat low sucrose (HFLS), OVX Low Fat Low Sucrose (LFLS), Sham OVX HFLS, Sham OVX LFLS, Non OVX HFLS, Non OVX LFLS, Male HFLS, and Male LFLS. The goal of this study is to draw correlations between diet, sex hormones, plasma RBP4 levels, weight, and fasting glucose and insulin levels in mice.
Folic acid (FA) is an essential nutrient for DNA synthesis, and is often prescribed to pregnant women as a supplement to prevent prenatal neural tube disorders. FA absorbs UVA radiation efficiently—a radiation that reaches the earth’s surface and can penetrate the dermis layer of the skin. Photoexcitation of FA forms photoproducts, thought to occur through an electron transfer mechanism. UVA-excitation of these photoproducts populates long-lived excited triplet states, which can transfer their energy to molecular oxygen to generate highly reactive singlet oxygen species capable of damaging cellular DNA (Thomas et al., 2003). Utilizing femtosecond broadband transient absorption spectroscopy, we investigate the electronic relaxation pathways in FA upon UVA excitation in order to provide direct spectroscopic evidence of the electron transfer event in aqueous solution. We also investigate the role of deuterated solvent in the electron transfer rate and propose a plausible mechanism for photoproduct formation.

The authors acknowledge the CAREER program of the National Science Foundation (Grant No. CHE-1255084 & CHE-1539808) for financial support.
Lesbian, gay, bisexual, or transgender (LGBT) individuals have long remained invisible in many communities, and as a result this diverse population has been largely under-researched and under-served. As recent studies have shown, LGBT individuals face a wide range of health disparities often tied to marginalization, stigmatization, and discrimination. This paper reviews the current state of knowledge on LGBT health disparities—an area of research that is impressive in breadth but which lacks depth in regards to many specific issues. By analyzing issues of the intersectional nature of sexual and/or gender minorities and ethnic or racial minority status, the impact of identity politics, and the effects of stigmatization one may better understand the nature of LGBT health disparities. It is clear that further research into the choices and challenges of the LGBT community vis-à-vis health are needed; as such, this paper will have an additional focus on mechanisms of stigma management, resiliency, protective factors like social support, cultural competency in settings of healthcare provision, and models of health equity promotion that reduce health disparities. The results of these interventions will be analyzed, and further research and intervention initiatives will be considered.
Abstract

Rapper Kid Cudi made headlines last year when he announced he was seeking treatment for depression and suicidal urges. This sparked a national conversation about stigmas surrounding mental health issues in African-American communities. With increased awareness brought about by this episode and others in the news and social media, more people now talk about how factors such as race can affect a person’s emotional and physical wellbeing. Anthropological and sociological research has also emphasized the intersection of race, socioeconomic status, and health in recent years. However, stigmas around mental health issues in African-American communities persist. Members of these communities may stress the need to portray attitudes of strength and mental fortitude. Through such attitudes, mental health issues can go unrecognized and treatment for such problems can be discouraged. Ill-informed perspectives held by some within the medical community also play a role in the lack of access to health resources or recognition of poor mental health. Many in the medical field often fail to consider how certain environments afflicted with poverty or crime can drastically impact those within the community. By examining both mental health stigmas in African-American communities and uninformed perspectives of some health care workers, this research seeks to contribute to increased mental health awareness and outreach among African-American communities.
Abstract

Ball and Chain is a multiplayer shooting game. Players will shoot at enemies, and destroyed enemies will release an “orb”. Collecting an orb will increase that player’s multiplier, making subsequent orbs worth more points. The game’s main feature is networked multiplayer, allowing multiple players on the same network to play together. Ball and Chain will be developed in the Unity engine for PC.

Our project consists of two main aspects of development: the gameplay and the networking. The gameplay will involve two to four opponents competing against each other in five minute rounds. Each player will have to accumulate the highest possible score they can within that time frame. The player with the highest score wins the round. To increase your score, you will have to neutralize enemies that are spawning around the map. The enemy will drop an orb that you must then collect before it is pushed outside the bounds of the arena. Collecting the orb increases your score. If you collect multiple orbs without missing one, you create a chain. The chain multiplies your score and makes it easier to increase your score. But be careful; your opponent can hit you as well! They will not damage you, but you will get pushed back. If they hit you off the edge, you will have to start your chain over.

The networking aspect will allow you to connect with your friends. When you and your friend is connected to the same network, you can play against each other. You can create a game and your friend can join you. You two will have hours of fun! You can also search for other games in the lobby. If any other game seems interesting to you, you will be able to join them. If you need to leave a game, you will be able to do so as well.
The microorganisms that inhabit the gastrointestinal tract are closely related to numerous aspects of human health. These microorganisms are capable of influencing the health of the brain by way of a bidirectional connection, known as the gut-brain axis. Such a connection implies that gut microbes can impact mental health of their host. This paper will review existing literature that connects the gut microbiome to major depressive disorder, one of the most common mental illnesses. By categorizing literature based on the pathway of the gut-brain axis on which each study focuses, this paper brings a new perspective to the present understanding of this relationship. The gut-brain axis consists of four main pathways: the autonomic nervous system, the enteric nervous system, the immune system, and the neuroendocrine system. Each has been shown to affect mental health, and framing existing research in the context of these pathways may provide insight into new potential therapeutic approaches.
Effective suicidal prevention—a work that needs to focus on both psychological characteristics and environmental aspects.

Suicidal prevention is not merely an issue of equifinality—the belief that different pathways will not lead to the same result. Even though suicidal prevention can be challenging, by focus on both psychological characteristics of the person in crises and certain aspects of their environment, we can effectively prevent suicidal.

Suicidal rates has been increasing in the United States since 2006. Each year, over 44,000 Americans take their own life. Suicides are related to many kinds of different psychological disorders, making suicidal prevention quite challenging. Many people even hold the opinion that suicidal prevention is merely an issue of equifinality—different prevention pathways just lead to same result, that death is inevitable. However, numerous clinical theories and treatment models have been shown that suicide can be effectively prevented if risk precursors are noticed in time and managed properly. In this project, I will dispel the myth that suicide is unpreventable by taking a look at the psychological factors that contributing to suicide, the reason why it can be prevented and the ways that can be implemented to prevent suicides. Theories based on empirical studies suggest that prevention should focus on both the psychological characteristics of the person in crisis and aspects of their environment. Emotional pain, emotion regulation difficulties, disconnection, and disillusionment are certain suicidal crises elements that can be commonly seen across individuals that attempted suicides and thus, should be carefully examined and managed.
When taking care of individuals with dementia, caregivers struggle to develop techniques that better the lives of their loved ones and alleviate some of the stresses in their duty of caregiver. Often times, these caregivers do not have adequate outside support and struggle to maintain consistency in their day-to-day lives. MyCompanion will provide completely customizable features to benefit the caregiver/loved one relationship. Features will include a memory book, to help loved ones remember previous experiences and current relationships, as well as a reminders list to create structure for a loved one’s daily routine among other features. Caregivers will also be provided with access to a quick help forum where they can find solutions to problems they are facing from caregivers in similar situations as well as provide/receive moral support in a group setting.
The role of caspases in tumorigenesis and novel cancer therapies

In cancer cells, caspase regulation may be dysfunctional, preventing them dying. Cancer therapy studies involving caspases have found evidence that the dying cancer cells release prostaglandin E2, which promotes cancer progression. More research is currently being done to gather more details on how this process occurs for clinical applications.

Key Words
Caspase
PGE2
Cancer

Abstract
This review aims to clarify the role of caspases in cell-mediated death and their role in novel therapies for cancer. While the role of caspases in normal cells has been studied in depth for decades, their dysfunction in cancer cells is less well-known. Controversy exists in the scientific community regarding the efficacy of upregulating caspases to promote apoptotic pathways in cancer cells. Some studies show that this targeted approach activates apoptosis, which kills the target cancer cells. For example, flavonoids found in herbal remedies and microbes that upregulate effector caspases have been very successful in reducing tumor growth, proliferation, and metastasis, potentially by inducing apoptosis. However, other studies show that this approach may also lead to the release of growth hormone prostaglandin E2 (PGE2) from the dying cancer cells. The PGE2 promotes residual cancer cells to proliferate and metastasize, speeding up the progression of the cancer. More research is necessary in the field of caspase regulation as an effective cancer therapy, specifically in the clinical setting, to gather a deeper understanding of the role of caspases in the cancer cells of patients.
Busting the Myth that Students Learn Best when the Teaching Style is Congruent with their Learning Style

The current research on learning styles and teaching methodologies is extremely diverse and contradictory. The layperson is inclined to believe that matching teaching style to learning style is most beneficial to the learning outcome, but the teaching style alone is the most accurate predictor of student learning across the research.

The issue with this style of research is that you are relying on the student to accurately know the teaching style that works most efficiently to enhance their overall learning outcome, which presents unreliable results.

Ultimately, the teaching style alone is the most accurate predictor of student learning across the current research, yet the findings are still very spread in terms of qualities and variables that are examined. Levels of instructor pressure, caring, involvement, support, student anxiety, and student levels of interest are among the variables that can affect the over learning outcome of a student, proving that this is a multi-domained topic, contrary to layperson belief.
A spring tire is a revolutionary rover tire design that NASA is currently developing and testing for future Mars missions. It outshines currently employed rigid tires by generating greater traction in fine soil, withstanding fatigue, and weighing substantially less. Additionally, the tire maintains its shock-absorbing shape through a tensile spring mesh as opposed to pressurized air which eliminates the risk of a puncture.

This report outlines the requirements of our “Mass Optimized Rim for Spring Tires” project and a rough product design we have developed to meet these requirements. The goal is to design a mass-optimized rim for a rover spring tire that is capable of enduring a set of given loads and torques over a series of cycles. The rim should be able to withstand a vertical drop onto a foreign terrain and maneuver across various environments.

The term “mass-optimized” refers to two main requirements of our project. The first involves reducing the mass of the rim to around 2 kilograms and the second involves designing a rim that efficiently interfaces with the spring tire mesh. Our primary goal remains the mass requirement while we still aim to find a lighter and stronger fastening technique to bind the spring mesh to the rim. Finite Element Analysis is conducted using Solidworks on various critical locations of the rim and tire system to determine where the material can be substituted for a lighter option.

The rim-tire system should be able to withstand a continuous load of 750N, peak load of 2500N, and still function when dropped at a one-time load of 11,000N. Furthermore, the tire should withhold co-axial torques of 850N-m and transverse torques of 350N-m.

The importance of a successful spring tire will help NASA further explore deeper regions of space. Specifically, if proven successful during testing, NASA plans to implement this new rim design in conjunction with their current spring tires to drive the rover for the Mars Sample Return mission in 2026.
With increasing social awareness on environment issues, following environmental legislation settled down, waterborne coating becomes ever important in the coating market. Meanwhile, Acrylic resins for paints and coatings are water base. As a critical coating application, waterborne acrylic polymers apply on interior and exterior wall of the building. Therefore, to create sustainable exterior coating on buildings, degradation of waterborne acrylic based paints applied as protective coating on exterior wall of the building is vital.

The current step of this research is to discover the relationship between different amount of titanium dioxide (TiO2) pigments and the durability and lifetime of polymeric exterior waterborne coatings. Environments of waterborne acrylic coatings with different amount of TiO2 are in outdoor exposure and accelerated exposures in lab. And the accelerated exposures are artificially-controlled conditions of temperature, humidity and solar irradiance based on ASTM G154 and G155.

FTIR, UV-VIS spectroscopy, colorimetry are the methods to evaluate the degradation of coatings. FTIR allows for detailed tracking the functional group changes as a material degrades. This data were collected step by step during long term exposure to track degradation process. For FTIR data, after baseline correction, normalization and Gaussian fitting, the curves on the FTIR data are smooth, on the same baseline. To understand the signals presented, we calculate peak ratio, full width at half maximum and integral of a Gaussian function in R software. Those responses are very important to present the degradation tendency. To better predict the degradation mechanism, semi-gSEM is built to find the relationship between measured responses and length of exposure time under different exposure conditions.
Using multielectrode arrays to investigate the spontaneous firing patterns and functional connectivity in large neural assemblies

The brain is active even in the absence of stimulation. Its spontaneous activity is not random but highly structured and can be used to investigate properties of neuronal circuits, for instance, functional connectivity, which is crucial to understanding how neuronal circuits process information. To address this question, it is necessary to record from large populations of neurons simultaneously, and overcome the traditional tradeoffs between spatial and temporal resolutions of standard electrophysiological and imaging methods. We attempt to solve this problem using high-density, two-dimensional, multielectrode arrays (MEA) to investigate spontaneous activity from the mouse neocortex in vitro. The arrays consist of 120 electrodes evenly spaced with 100 um pitch over an octagonal area spanning over 1.2 × 1.2 mm2. This technology enables the study of activity patterns with unprecedented temporal and spatial resolutions in cortical circuits. Using spike-sorting algorithms, action potentials from multiple cells can be resolved from each electrode in the MEA, so that we can potentially identify on the order of hundreds of neurons in a single experiment. In preliminary studies, the neurons displayed different types of spontaneous firing patterns over a wide frequency range, from less than 0.1 Hz to more than 100 Hz. Some neurons fired tonically, some transiently, and some in regular bursts. From the firing patterns, we were able to investigate functional connections between neurons at different locations in the neocortex, and identify neurons with important roles in the network. These results open up a new avenue to investigate the activity and functional connectivity of neural circuits.
Abstract

The process of localizing faults, or finding bugs, is an expensive problem that takes up much of developer time. There are many methods in the literature for automatic fault localization, which analyze data derived from run-profiles on some significant number of tests. Combined with the knowledge of which tests passed or failed, these methods find a correlation between test failure and some feature of the profile (classically, statement coverage). The method proposed in this paper improves upon that model in two ways. First, it employs methods of causal inference to reduce the likelihood of confounding factors influencing the result. Second, it uses dynamic object-state data to consider the causal effect of function outputs, rather than the classic statement coverage.
Abstract

Living cells communicate by secreting "messenger" molecules that carry signals to nearby cells via diffusion. One way a sender cell can transmit information is by influencing the concentration of the signaling molecules in the vicinity of a receiver cell. But diffusion is a stochastic (random, noisy) process at the level of individual cells and molecules, and the received signal is only an approximation of the original. In order to quantify the relationship between the "sent" and "received" signals, we model this communication channel as a source injecting molecules at rate $S(t)=S_0*(1+a \sin(w t))$, with molecules diffusing according to diffusion constant $D$, and decaying (or escaping) with rate $\alpha$. The resulting concentration $c(t)$ at a distance $L$ from the source will be a noisy, attenuated, phase-shifted version of $S(t)$. Through calculations and numerical experiments I study the relative strength of the noise and signal amplitude at the receiver and how they change with the parameters $D$, $\alpha$, $S_0$ and $w$. 
Marathon Petroleum Corporation is primarily concerned with the production of oil and gasoline from crude oil. Environmental standards and smog issues in high population cities have resulted in a necessity for the production of gasoline with a lower RVP (Reid Vapor Pressure), especially during summer months. It is desired to produce low RVP gasoline in the alkylation unit of the refinery in Canton, Ohio. Alkalyation is the process for gasoline production that reacts short-chain hydrocarbon (C3, C4) olefins with hydrofluoric acid in order to create high octane gasoline known as alkylate. The goal of this project is to increase the RVP of Marathon's alkylate by removing more volatile components, primarily n-butane. Simulations performed using ASPEN HYSYS have were used to investigate the feasibility of the production of low RVP gasoline through the modification of an existing distillation column and by the addition of a new distillation column. Optimal total installed cost (TIC) is determined through an iterative process using the HYSYS Activated Analysis.
### Abstract

In October 2016, South Africa became the first country to begin withdrawal procedures from the International Criminal Court (ICC). This paper explores the implications this withdrawal will have on recent trends towards international legalization and stresses the importance of local politics and local leaders in affecting international law. It does so by first examining the importance of the ICC as a mechanism that promotes global norms and builds dialogue between regulators. Secondly, it recognizes that these mechanisms are ultimately decided and defined by local politics and suggests that the withdrawal was a political maneuver by President Jacob Zuma to increase support for the African National Congress (ANC) after it suffered setbacks in recent local elections. While the ICC has been criticized for an unfair bias towards African countries and these criticisms represent a notable flaw in the court system, South Africa’s withdrawal exploits the response of the international community to increase local support for the ANC.

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**Key Words**

- South Africa
- International Law
- International Legalization
- International Criminal Court

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In South Africa's decision to withdraw from an international legal body that convicts leaders for crimes against humanity is important because they are a leader on the African continent and other African countries could follow suit. However, their decision to withdraw was based on local politics rather than a calculated move to challenge the international system.
Animal behavior requires the integration of multiple sensory information streams. For flying animals, stability and control require the rapid integration of visual and mechanosensory information. Information about body rotations in flying flies is provided with high speed and precision by the halteres, reduced hindwings that are essential for fly flight. Octopamine is a neurotransmitter that creates physiological changes in the fly's body during flight. In this study, we examined the head movement behavior of intact fruit flies, flies with complete haltere ablations, wingless flies, and octopamine deficient flies in the absence of rotational body movement. Each group of flies flew on a rigid tether in different visual contexts. Although haltere input is necessary for spiking activity in some neck motoneurons of larger flies, we found that haltere removal did not decrease the flies' range of head movements. We also found that head response is smaller in haltereless flies at higher wide-field visual motion speeds. Additionally, we found that head movements in response to visual stimuli only occur during flight, and octopamine-deficient flies have fewer head responses to visual stimuli.
The relatively recent advent of multiple-electrode recording makes it possible to study the simultaneous spiking activity of hundreds of neurons. This allows us to understand how groups of neurons act in the context of a network and work together to define the function of a given brain circuit. We are interested in spontaneous activity in the brain's neocortex because our lab have previously shown that it provides a means to investigate functional connections between neurons in those brain circuits. The electrical signals (voltage spikes) produced by spontaneously firing neurons are recorded by the multi-electrode array (MEA). Since each electrode records spikes from multiple neurons, a crucial step in the analysis is to sort them out. In this project, we contrast an automatic spike sorting algorithm and manual selection of spike clusters to test the reliability of such an algorithm. The ultimate goal of my project is to map the firing patterns of spontaneous activity of mice brain slices and investigate their dynamics and connections. My preliminary data demonstrate some functional connectivity properties of brain circuits through graph theoretic measures. I also show that there can be discrepancies between experiments sorted with different spike sorting routines.
Peroxisome proliferator-activated receptor gamma (PPAR?) is vital for proper glucose homeostasis. This nuclear receptor is the molecular target of thiazolidinediones (TZDs), which are FDA-approved drugs for the treatment of type 2 diabetes. Specifically, TZDs enhance insulin sensitivity by activating PPAR? receptors and thus, increasing the activity of PPAR?. Hence, molecules that regulate PPAR? are important therapeutic targets for developing novel T2D drugs. Recently, a relatively unknown protein, Zinc Finger And BTB Domain-Containing Protein 9 (ZBTB9), was discovered to have a physical interaction with PPAR?. We have determined that over-expression of ZBTB9 increases the activity of PPAR? by more than 20-fold in vitro. Unfortunately, very little is known about both ZBTB9 and the mechanism through which it modulates the activity of PPAR?. We have discovered that the over-expression of ZBTB9 does not affect the protein levels of PPAR?. Additionally, we created mutations of residues responsible for PPAR? post-translational modifications. The co-expression of these mutants with ZBTB9 did not diminish the agonistic effect of ZBTB9, indicating that ZBTB9 does not regulate the activity of PPAR? through these post-translational modifications. Although more research is required to elucidate the mechanism through which ZBTB9 affects PPAR?, ZBTB9 may represent a potent modulator of the PPAR? signaling pathway.
**Abstract**

Medical auto-injectors allow for easy, accurate drug administration by both healthcare professionals and patients. However, there are two main issues with current auto-injector designs. First, current designs cannot handle the high injection forces that many high viscosity drugs require for quick and easy administration. Second, most existing auto-injectors rely on a long plunger system to push the dosage out during use. However, since the unextended plunger system must be at least as long as the vial itself, this can result in a relatively lengthy device as compared to the size of the actual vial. As a result, most auto-injectors end up being 8-10 inches long.

We aim to design an efficient and compact auto-injector by utilizing a collapsible plunger column that would not only reduce this need for extra storage and actuation space, but would also increase the overall administration force. Our collapsible column is modeled off the Gala Spiralift system that is currently used to lift the weight of concert stages by meshing a doubly slotted ribbon with a toothed helix. The ribbon is wound into a column and the toothed helix fits through the slots in the ribbon to lock the top part of one ribbon section to the bottom part of a later section. Through this method, a single piece of ribbon is able to stack up to form a long column that is secured in place and supported by the inner toothed helix. These two components can then be unmeshed and stored in a very compact state.

Utilizing this concept, we will create a miniaturized column to push a syringe plunger. We are exploring adaptations that simplify this two-piece system through the use of a one-piece self-locking ribbon, a column supported by the walls of the syringe vial, or a grooved single-piece ribbon capable of self-stacking. Along with the functional prototype we will produce a testing report confirming its functionality and accuracy, as well as a manufacturing report with recommendations for mass production.
Enabling services are defined as non-clinical services that are provided to health center patients that promote, support and assist in the delivery of health care and facilitate access to quality patient care. Examples include case management, interpretation, transportation, or health education. Enabling services are often jeopardized by political and financial pressures because they are nonreimbursable services. In addition, the limited amount of data currently collected by UDS includes little information on the levels of utilization, the characteristics of enabling services users, and the amount of time dedicated to providing these supportive services. This mixed-methods research study was designed to compare the characteristics of enabling service users versus non-users within a Federally Qualified Health Center serving primarily Limited English Proficient populations. Compared to non-enabling service users, the characteristics of enabling services users are different and may impact health outcomes. Identifying the characteristics between enabling service users versus non-users will provide a better understanding of the relationship between enabling services utilization and health outcomes for Limited English Proficient patients. In addition, the impact of enabling services can help policy makers effectively address health centers, as they improve access and quality care to medically underserved.
**Title**: Ibuprofen-Mediated Regulation of Microtubule Dynamics in Cystic Fibrosis Epithelial Cells

**Abstract**

Cystic fibrosis is a pediatric pulmonary disease which stems from mutations in the gene encoding the cystic fibrosis transmembrane conductance regulator (CFTR). Cystic fibrosis patients experience a continuous decline in pulmonary function in part due to chronic airway inflammation. Currently, the only anti-inflammatory approved by the CF Foundation is high-dose ibuprofen, where benefits range from a decrease in lung disease progression to reduced neutrophil migration to decreased propensity for nasal polyp growth; however, harmful side effects discourage use of the treatment. Interestingly though, many of these benefits remain unexplainable as well as how absence of CFTR function enhances inflammatory signaling. The hypothesis of the study is that high-dose ibuprofen improves inflammation through a novel mechanism using microtubules. Previously, it has been shown that modifications of microtubules by acetylation are decreased in CF epithelial cells. The decrease in microtubule acetylation contributes to decreased intracellular transport along microtubules resulting in inflammatory signaling. Decreased microtubule acetylation is indicative of decreased microtubule stability, a consequence of either impaired microtubule polymerization or enhanced depolymerization. We have identified impairment in polymerization in CF cells. In this study, the effect of high-dose ibuprofen on microtubules was examined. This treatment resulted in a significant increase of polymerization rates in CF cells. Enhanced microtubule polymerization was confirmed primary nasal epithelial cells obtained from CF patients after ibuprofen treatment. Further, these results were specific to high-dose ibuprofen, seeing that aspirin, acetaminophen, and celecoxib did not fully restore polymerization rates. Together, these data support microtubule structure and dynamics as an important facet linking CFTR to inflammation.
Abstract

Air pollution has become a global environmental issue associated with the rapid development of industrialization. Volatile gases and small suspended particles ranging from nanometer to micrometer (i.e., dust from car or factory emissions) are easy to be inhaled into human lungs. The long-term exposure to such air pollutants can lead to allergic symptoms and even serious diseases. Since people spend most time in the building, indoor air quality control plays an essential role to limit human's exposure to environmental contaminations in. Here we present a nanocomposite fiber for air filtration to improve indoor air quality. Polyvinyl chloride (PVC) nanofiber membrane was fabricated using electrospun technique, and further loaded with functional nanoparticles TiO2 on the fiber surface. PVC nanofiber has potential to adsorb floating pollutants due to its excellent filter function associated with its large surface areas. TiO2 is well known as a photo-catalyst to break down harmful pollutants energized by ultraviolet lights, thus assisting improving filtration efficiency with nanofiber. Nano TiO2 particles have been transferred to fiber surface through direct-dissolving and electrospraying, respectively. The photocatalytic functionality of TiO2 by two different means are tested and discussed. This PVC/TiO2 nanocomposite filter is suggested to be installed on the windows or doors, and purify the air that enters room from outside.
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**Abstract**

Class sizes for introductory computer science classes are so large that it is becoming infeasible to grade coding assignments without some degree of automation. While there exist tools to facilitate running code for generic purposes, none exist that are targeted specifically at the use-case of a classroom. PySchool aims to be a grading system which targets convenience for both students and instructors, considering both roles individually.
This project is an Android application that allows users to complete, create, and share nonogram puzzles. Nonograms are logic puzzles where the player must fill in cells in a grid based on constraint numbers listed along the columns and rows of the grid. The grid can be of any rectangular size and the goal of the puzzles is to correctly fill in the grid, usually to reveal an image. The purpose of this application is to provide a single source which meets all users’ nonogram needs. The application will allow users to connect and compete with each other in the completion of nonograms.
Background: Information on risk factors, incidence, and survival of eccrine malignancies is limited. The objective of the current study was to describe the incidence of and survival from primary eccrine malignancies.

Methods: We used data from the 18 registries of the Surveillance, Epidemiology, and End Results (SEER) Program from 2000 to 2013. Diagnoses of malignant eccrine spiradenoma, eccrine papillary adenocarcinoma, eccrine poroma, and eccrine adenocarcinoma were included and analyzed discretely. The cause of death, relative frequencies, five/ten year survival rates, and incidence rates were calculated. Each parameter was analyzed by age, specific type of eccrine malignancy, residence location (urban/metropolitan), race, sex, and SEER Registry.

Results: Overall age-adjusted incidence was .10 per 100,000 person years. The incidence of eccrine carcinoma increased significantly (approximately +3.23% annual percent change) from 2000-2013. Incidence among men was significantly greater than women (95% CI of rate ratio: 1.35-1.65). Incidence among white-Americans was significantly greater than non-white Americans (95% CI of rate ratio: 1.21-1.63). Five-year relative survival of eccrine carcinoma was 92.88% (95% CI: 94.10%-97.48%). Increased age, male sex, black race, rural (as opposed to metropolitan) residence, and occurrence of malignant eccrine spiradenoma (as compared with papillary adenocarcinoma, poroma, and adenocarcinoma) were associated with significantly higher all-cause mortality (p<.01).

Conclusions: This is the largest population-based study of eccrine malignancies to date. Although the overall incidence of eccrine malignancies is increasing, the overall mortality has decreased. Recognition of the unique demographic profile of eccrine malignancies as per this research is crucial in understanding the etiology of different eccrine malignancies and determining how to prevent and care for this disease in the future.
The Celebration of Student Writing and Research showcases undergraduate student writing projects from across the university. The celebration encourages students to (re-)present and display their research and writing in formats other than conventional word-processed documents. Some students create video projects; others produce poster presentations or read aloud portions of their writing; still others design models or digital illustrations that present their writing projects in new media.

The Writing Resource Center coordinates the Celebration of Student Writing and Research. The Writing Resource Center (WRC) at Case Western Reserve University provides writing consultation to students across the university in Bellflower Hall and other campus locations as well as online. More than 40 full-time Writing Program faculty and graduate students staff our center. Each year, WRC consultants conduct more than 5,000 individual sessions with approximately 1,500 individual students ranging from first-year writers to graduate students and faculty.

The Center for the Study of Writing, which in part supports the Celebration of Student Writing and Research, was established in 2008 to facilitate research and scholarship on writing at the University and in the world. It serves three distinct but interrelated roles at the University: to support writing and research by resident and visiting students and scholars; to facilitate exciting new courses and curricula on writing; and to provide an array of practical writing and publishing support services to the University and University Circle communities. For more information, see http://www.case.edu/writing/csw.

Since 2009, the Center for the Study of Writing has been sustained by generous gifts from Marilyn McCulloch (FSM ‘50); from Edward S. Sadar, M.D. (ADL ‘64, SOM ‘68) and Melinda Melton Sadar (FSM ‘66); from Sharon Schnall (MBA ‘87) and Dr. R. Drew Sellers (EMBA ‘08); from Eric Winter, M.D. (CWR ‘98, GRS ‘91, MD ‘98); from Jackson McHenry (ADL ‘52); and from an anonymous donor.

The Celebration of Student Writing and Research is additionally supported by the SAGES Program and the Department of English.
Courses and Organizations:

**Course:** USSO 234: Questions of Identity  
**Course Instructor:** Gail Arnoff  
**Students:** Jared Kokinos, Jared Molnar, Sara Young, Pauline Brenner, Halle Rose, Anita Lu, Zhitao Jia, Denasia Wagner, Tasha Johnson, Annmarie Watson

Using 8" by 8" foam core tiles, students will decorate them to reflect their identity. They may use any kind of materials. In addition, each student will have a printed statement which explains what they have done to make the tile represent who they are.

**Course:** FSCC 100: First Seminar: Health & Narrative  
**Course Instructor:** Mary Asad  
**Students:** Tingting Bao, Xihang Bian, Hoang Dang, Rong Fan, Jiahui Ma, Anh Tran, Lanyi Xu, Hao Yang, Yuan Yuan, Fang Zhang, Hannah Zhang

This section of First Seminar for international students examines the persuasive potential of narrative, specifically in the context of health and illness. Students spend time analyzing narratives (from the genres of memoir, TED talk, graphic novel, and film) before selecting a health topic of personal interest to research during the rest of the semester. Based on their research, they create educational and persuasive comic books aimed at specific target audiences. Then, they deliver in-class presentations modeled on the TED talk. Finally, their Celebration posters adapt their health topics to reach a general audience of CWRU faculty, staff, and students.

**Course:** USSO 291 K: The Great Western Schism  
**Course Instructor:** Sarah Bania-Dobyns  
**Students:** Tony (John) Yambor, Tess Krope, Mark Hornyak, Diana (Sungmin) Kim, Annie Hu, Tamara Herst, Branden Kraus, Aaron Holland, Taylor Woodcock
**Student Group:** Discussions: The Case Western Reserve University Undergraduate Research Journal

**Mentor/Advisor:** Sheila Pedigo

**Students:** Abhishektha Boppana, Wesley Maddox, Monica Windholtz, Daniel Mendez, Nicholas Curtis, Torrey Guan

Discussions is Case Western Reserve University’s undergraduate research journal. We publish two to three issues each year and feature research in all disciplines in order to promote undergraduate exploration in the sciences and humanities. If you are interested in assisting us in the publication process or if you wish to submit an article to Discussions, please visit our website at case.edu/discussions.

**Course:** USSY 286S: Shakesploitation

**Course Instructor:** Barbara Burgess-Van Aken

**Students:** Hannah Boylan, Sam Concannon, Sam Neal, Brendan O'Donnell, Kobe Wanko, Kirsten Wetzel, Mei Wong, Aisha Zamir

This digital book projects looks at how four Shakespeare plays have fared in popular culture. We present chapters on Hamlet, Henry V, Twelfth Night, and The Tempest

**Course:** FSCC 100.107 (11796): Humans and Technology

**Course Instructor:** Ana Codita

**Students:** Yiqi Chen, Zhixin Chen, Jinquan Liu, Junkai Wang, Yaoling Wang, Kakin Xi, Haoran Xu, Zheng Tao Yu, Kaixuan Zheng, Sizhe Zhu

The course explores the relationship between human identity and technological progress.
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The theme of this SAGES First Seminar course this semester was Humans and Society. Some of the topics investigated include: the influences of technology on the mind; technology addiction; biotechnology and its implications; artificial intelligence; microchips in humans; and digital identities. One of the assignments in this course was to write a small survey-based research essay in which students examined attitudes towards different issues related to technology. At the Celebration of Student Writing and Research event, students will display mini-posters of their research essay.
**Course:** USNA 287K: Human Research Ethics: Scientific Truth vs. Cultural Belief

**Course Instructor:** Michael Householder

**Students:** Katie Bernard, Chris Brace, Dillon Brown, Madeline Garb, Alex Goldberg, Princess Honnah, Noel Jeansonne, Saloni Lad, Jimmy Nagy, Eric Pomper, Jake Stillman, Lidia Waidman, Jacob Wang, Anna Pearl Wright, Abigail Yaffe, Kevin Yang

USNA 287K: "Human Research Ethics" examines ethical problems that emerge when the scientific drive to know conflicts with people’s cultural beliefs. For their final project, students studied an incident in which scientists used donated blood samples to do research on the Havasupai Indian tribe. Tribal members accused the researchers of using their blood for studies for which they did not consent and disrespecting their cultural beliefs. Using the lessons learned from this incident, students are writing a report to the research community at CWRU, outlining their recommendations for the responsible conduct of research when working with Native Americans.

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**Course:** FSCC 100-11790: Language, Diversity, and Multilingualism

**Course Instructor:** Hee-Seung Kang

**Students:** Noel (Jiahe) Chen, Alex (Haoliang) Guo, Crystal (Yunshangwei) Fang, Sammie (Yihe) Guo, Leo (Yuqi) Hu, Cathy (Yiying) Li, Duncan (Daohan) Lu, Phuong Phung Uyen Nguyen, Jason Sun, Louis (Nhi) Tran, Karl (HaoChen) Na Wang, Jasky (Jiaqi) Yang

In Language, Diversity, and Multilingualism, students examine language as a social practice and examine language use and diversity from a broad social, cultural, and historical context. Students in groups chose a topic related to diversity on campus and conducted surveys. The students in this class, who are bilingual and multilingual, will share their research questions, research methodology, and some interesting findings. Students will also provide interpretations of the research findings along with future research implications.
Course: USSY 292T-100: Half-Truths and History in Fiction

Course Instructor: Caitlin Kelly

Students: Ruben Dockery, Michael Klein, Amanda Lawrence, Tobili Hatcher, Rachel Baumler, John Libert, Carolyn Miller, Bridget Rabaglia, Sierra Cotton, Kayla Kowalski, Meghna Nadella, Danielle Moran, Katrin Gurvich, Brian O'Rourke, Kaelee Parker, Josh Heri, Derek Clontz

“Half-Truths and History in Fiction” invites students to think about what is at stake when we represent real-life people and events in imaginative texts. In the projects featured here, the students were tasked with defending one of our course texts from threats to ban it from a classroom or campus, or from a community reading group.

Course: USSY 285v: Castaways and Cannibals: Stories of Empire

Course Instructor: Kristine Kelly

Students: Tessa Askew, Jared Cassarly, Sarah DiGennaro, Lucas Invernizzi, Sneha Iyer, Emily Kiener, Abigail McCoy, Patrick O’Donnell, Hiripan Ontiveros, Il Woon Park, Rhiannon Reese, Sean Stevens, Esmeralda Terrazas, Josie Thal, Paul Tremonti, David Tyler, Alex Zang, Kristine Kelly

Our project presents a collection of analyses of seven different primary source documents that describe the writers' engagement with nineteenth and early twentieth century British imperial expansion and global travel. After selecting documents from the Empire Online database, we considered the insights these works offer into the (his)stories of the British Empire or of resistance to those stories. We then collaborated to write and design media-rich analyses of these works using Scalar, a web publishing platform developed at USC. Our analyses are supplemented by images, video, creative visualizations, and associative contemporary connections.
Throughout history and across cultures, education has been viewed by many as a way to personal fulfillment and success. When public discourse oftentimes depicts education as an equal opportunity to a better life for all, what is missing in our narratives about education and who is left out of the discussion? In our poster presentations, we will explore answers to these questions through engaging with original research investigating issues related to race, culture, gender, and more in the field of education.
Course: FSCC100 section#11793: An Equal Opportunity for All?---Exploring Equity Issues in Education

Course Instructor: Shaofei Lu

Students: Bosen Cao, Yifei He, Yujing Wen, Huixian Yang, Tian Yang, Yifan Yuan, Xinzhi Zhang, Hongyi Zhao, Qianzi Zhou, Bingxuan Zhu

Throughout history and across cultures, education has been viewed by many as a way to personal fulfillment and success. When public discourse oftentimes depicts education as an equal opportunity to a better life for all, what is missing in our narratives about education and who is left out of the discussion? In our poster presentations, we will explore answers to these questions through engaging with original research investigating issues related to race, culture, gender, and more in the field of education.

Course: USSY 290U: Poetry for Poetry Haters

Course Instructor: Dave Lucas

Students: Kelsey Holmberg, Yujie Hu, Joshua Lehrberger, Chloé Lim, Andrea Lu, Kaitlin Pataroque, Roston Shore, Alexander Yaney

The course considers (implicitly and explicitly arguing for the academic validity of) a variety of poetic texts often marginalized from literary study, including the poetic artifacts of persons often underrepresented because of socioeconomic or racial biases. Moreover, in considering these texts as of congruent status traditionally “literary” poetry, the course will challenge students to evaluate the social and cultural circumstances of canon formation both in the academy and in popular culture.

We conclude our semester-long inquiry into poetry with a mock academic conference composed of panel discussions on several different topics related to issues in poetry and poetics. Students will choose the subject matter and panelists (groups of three or four) for their panels. Groups will present excerpts from their papers as part of a panel presentation at the Celebration of Student Writing and Research, and will then engage in a discussion among members of the panel before opening the floor to questions from the audience.
Course: USNA249: Restoring the Great Lakes: Opportunities and Challenges

Course Instructor: Glenn Odenbrett

Students: Kayla Buckelew, Emily Freise, Nathaniel Choo

Student teams in consecutive semesters of USNA249 have been investigating the Lake Erie fish consumption habits of subsistence anglers to determine how aware they are of the toxins these fish contain and the health risks associated with consumption of these fish in excess of recommendations contained in public fish advisories. Students will present the outcome of subsistence angler interviews as well as plans for signage at locations where they frequently fish along the Lake Erie shoreline in the Greater Cleveland area.

Course: USNA 237: Landscape History and Conservation

Course Instructor: Erika Olbricht

Students: Fatimah Abouelsoud, Juana Barrera, Kyla Cherry, Rozaida Diaz Soto, Katie Francissen, Emma Hock, Alaina Lisanti, Jennifer Manning, Brittany Rabb, Baelee Roach, Spiros Romell, Michael Rowland, Marquis Sanders, Emma Savino, Rayna Sayles, Morgan Wood

This SAGES course investigates the practices and rationales involved in conserving historic landscapes. Students have researched political and cultural sites, restored ecosystems, cemeteries, city parks--both natural and industrial--and national parks.
**Course:** USSY 292Q: The Secret Lives of Animals

**Course Instructor:** Arthur Russell

**Students:** Lucas Alva-Ganoza, Alexis Balog, Roshni Bhat, Rory Blochl, Vera Bostwich, Grant Brown, Heather Eby, Darby Hickson, Karley King, Mila Koleva, Crystal Ma, Bailey McMahon, Tyome Niroomand, Mitchell Peer, Adrienne Simmons, Jenna Sullivan, Tara Tadimalla, Xavier Yozwiak

Course Description: Animals are instructive. When we study animals, their biological makeups and creaturely habits, what do we hope to learn? The study of animals, in scientific and literary laboratories alike, often turns to acts of self-discovery - not what it means to be animal, exactly, but what it means to be human. Our interest in animals, in other words, is often an interest in ourselves. So what more could we learn by cultivating new strategies for listening and new languages for communicating with animals? This seminar invites students to investigate the secret lives of animals as imagined in a sampling of classical, medieval and modern literatures. Thinking with the animals of past and present - in fables, manuals, and tales - we will examine human-animal relationships in imagined settings. Over the course of the semester, we will read, view, and listen to works in which animals are tasked with teaching moral lessons and testing the ethical obligations of their human audiences. Comparing treatments of companion animals past and present, we will reflect on the way literature guides our evolving relationship to the animal kingdom.

**Organization:** CWRU Writing Program

**Advisor:** Martha Schaffer & T. Kenny Fountain
Our class has begun a project to map the human genome! Each student investigated a gene on one of our 23 chromosomes and explored the trait, behavior, disorder, or illness caused by that gene. Using Scalar, a web publishing program developed at USC, we set up 23 chapters (each for a chromosome plus XY) and then added our findings on individual genes in a media-rich, interactive digital environment. Our intended audience for this project is high school students and adult readers with a minimal background in the field of human genetics, and we hope they enjoy learning on our site. We intend to have future USNA 271 classes add pages to the chapters in this project in the hopes that it will someday represent the entire human genome!
SOURCE
Support of Undergraduate Research and Creative Endeavors at Case Western Reserve University
http://case.edu/provost/source/intersections/intersections.html

Origami is a rich, mathematical art that takes life from the intersections and synthesis of intricate folds.