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Research ShowCASE Abstract Report

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Full Abstract Report
Kangaroo Care and Postpartum Depression: The Role of Oxytocin

• Problem: Postpartum depression (PPD) occurs in about 10–15% of women after birth and adversely affects their health and the health of their newborn. Kangaroo care (KC) is known to have many health-related benefits for both mother and newborn; however, a systematic review of its effects in reducing PPD has not been done.

• Purpose: The aim of this review was to gather the evidence linking the effects of KC on PPD, specifically focusing on the proposed underlying mechanism involving the release of oxytocin.

• Search Strategy: The review included studies published between 1995 and 2015. Data sources were: PubMed, CINAHL, and Google Scholar. Search terms included: postpartum depression, postnatal depression, oxytocin, oxytocin hormone, central oxytocin, postpartum depression, kangaroo care, and skin-to-skin contact.

• Results of literature search: Twenty studies met the search criteria and were included in this review. Most of the studies used descriptive correlational designs; four involved randomized controlled trials; other studies were quasi-experimental, qualitative, or involved meta-analysis.

• Synthesis of Evidence: KC was found to play an important role in decreasing the risk for PPD. Skin-to-skin contact during KC was found to trigger the release of oxytocin, which is hypothesized to minimize the risk for depressive symptoms as well as to decrease the maternal stress. The oxytocinergic system regulates the release of oxytocin, which is opposite the effect that occurs with the human stress response, in which the sympathetic nervous system is activated to release catecholamines in response to harmful, or threatening stimuli. The oxytocinergic system regulates calmness, connection, and socialization processes. During KC, oxytocin blocks the stress response and decreases the circulation of catecholamines, yielding positive outcomes that include maternal stress reduction and prevention of PPD.

• Implications for Practice: KC can be used as a non-pharmacological intervention to reduce maternal stress and to prevent or decrease the risk for PPD. Mothers at risk for PPD should be encouraged to use KC. However, evidence-based practice requires additional research, including more studies to explain the physiological mechanisms underlying KC in relation to maternal stress and depression, particularly studies with large, diverse samples involving more rigorous designs and analyses.
Meta-analysis of the Predictive Factors of Postpartum Fatigue

Purpose: Nearly 64% of new mothers are affected by postpartum fatigue, which can lead to serious negative effects on the mother’s health and the newborn’s development. The aim of this meta-analysis was to identify predictive factors of postpartum fatigue and to document the magnitude of their effects using effect sizes.

Questions / Hypothesis: Research questions were: 1) What factors have researchers identified as predictors of postpartum fatigue; and 2) How strongly do these factors influence the onset of postpartum fatigue.

Theoretical framework: Runquist’s middle-range theory of “persevering through postpartum fatigue,” which suggests there are key factors that influence the onset of postpartum fatigue, provided the foundation for this meta-analysis.

Method: Two search engines, PubMed and Google Scholar, were used to identity studies that met two inclusion criteria: 1) identification of a factor(s) that predicted postpartum fatigue; and (2) reliable and valid measurement of the predictive factor(s). Seven articles met these inclusion criteria. The direction and strength of correlation coefficients between predictive factors and postpartum fatigue were examined across the studies to determine their effect sizes.

Results: Across the seven studies (published 1998-2014), 890 women with postpartum fatigue were sampled. Measurement of predictor variables occurred from 3 days to 6 months postpartum. Correlations reported between predictive factors and postpartum fatigue were as follows: small effect size (r range = .10 to .29) for education level, age, postpartum hemorrhage, infection, and child care difficulties; medium effect size (r range = .30 to .49) for physiological illness, low ferritin level, low hemoglobin level, sleeping problems, stress and anxiety, and breastfeeding problems; and large effect size (r range = .50+) for.
Abstract

Dentin sialophosphoprotein (DSPP) is the most abundant non-collagenous protein in dentin which can be used as a marker for the differentiation of Immortalized Stem Cells from Human Exfoliated Deciduous Teeth (iSHED) into dentin-secreting "odontoblast-like" cells. Recent studies have shown iSHEDs ability to differentiate into functional odontoblast which might play a critical role in dentinogenic regenerative therapy. However, iSHEDs behavior under inflamed conditions triggered by bacterial insults is not well investigated. There are controversial results regarding whether induced inflammatory reaction caused by LPS might affect iSHEDs ability to express DSPP. Objectives: To investigate the effect of various concentrations of LPS on the expression of DSPP by iSHEDs. Hypothesis: We hypothesized that the application of greater than 100 mg/mL LPS would reduce the amount of DSPP expressed by iSHEDs. Materials and methods: SHEDs were transfected with a recombinant Lentivirus to generate iSHEDs. Generated cells were divided in four groups: 1) untreated (control) 2) LPS 10 mg/mL 3) LPS 100 mg/mL 4) LPS 200 mg/mL. Mean DSPP production was measured using ELISA kit and data was statistically analyzed using non-parametric Kruskal-Wallis Test since normal data distribution was not observed (?=0.05, SPSS ver21.) Result: There was no significant difference between iSHEDs treated with 10 and 100 mg/mL and untreated iSHEDs regarding DSPP production (p=0.65). However, 200 mg/mL LPS treatment was shown to significantly inhibit DSPP production by iSHEDs (p=0.035) Conclusion: Considering the negligible effect of low concentration LPS on DSPP production, it might be speculated that low grade inflammatory response caused by LPS might not significantly affect the differentiation of iSHEDs into odontoblasts.
Modeling redox flow batteries requires solving numerous coupled differential and algebraic equations. Recently, several groups have described models for all-vanadium systems, but the models are only able to find quasi-equilibrium solutions, and generally don't include side reactions that have important effects on long-term behavior. They also assume equal current densities for charging and discharging, which may not reflect realistic battery operation. Here, we show a new model for an all-iron flow battery system that includes all relevant side reactions and hydrogen-ferric ion recombination, as well as more realistic charging, discharging and rest periods. By including these additional features, the model is capable of finding true equilibrium cycling behavior. This approach enables new methods to understand and predict battery performance and stability in ways unachievable with previous models, and is applicable to a wide variety of flow battery systems.
The flipped classroom (FC) is an emerging format for introducing content into the medical curriculum. While studying applications of the FC in the second year medical student course (Block 6), it became clear that participation in FC has implications for the teacher/facilitator, as well as the learner. One application of the FC in Block 6 is the medium size group (MSG), in which foundational material is presented prior to class time, followed by in-class discussion among basic science faculty and Neurology PGY3 residents (NPGY3R) and students. To assess the impact of the MSG instructional material upon faculty and NPGY3R content acquisition, we generated an evaluation survey that accessed an individual’s self-reported prior content knowledge and content acquisition and comfort level as teachers of this content. The MSG instructional material was constructed collaboratively by sharing a draft of the facilitator guide, which includes questions, ideal answers and supportive diagrams, with faculty and NPGY3R. In addition, a video on the topic of “Neurotransmission” was created and was required viewing by all participants. In advance of the MSG session with the students, all facilitators met on two separate occasions to review the content. After the MSG session, a survey assessing facilitator knowledge base and confidence in teaching the content was distributed. In eight of thirteen content areas addressed, NPGY3R reported significantly “improved understanding” of the material covered in the MSG. In contrast, faculty only reported that increase in one content area. Over all residents, the correlation between their “improved understanding” and their “comfort in teaching” a particular content was 0.66. For the faculty the correlation coefficient was 0.84. The MSG offers an ideal format for facilitators, particularly NPGY3R, to learn the material and gain confidence as teachers. Considering student experience is so heavily influenced by the understanding of the facilitator, facilitator education through participation in MSGs is worthy of continued research and support. The added value that NPGY3R bring to medical education is an under-developed resource in our curriculum. The authors hope to continue to assess student and NPGY3R impressions of their experiences and roles while collaborating in MSG sessions.
Changes in the electrocatalytic activity of Pt for the oxygen and hydrogen peroxide reduction reactions (ORR, and HPRR, respectively) in an aqueous acidic electrolyte induced by the adsorption of bromide, as a model impurity, have been investigated using chronoamperometric techniques under forced convection. Experiments were carried out using a polycrystalline Pt|Pt rotating ring-disk electrode in O2-saturated 0.1 M HClO4 containing 10 ?M KBr (2.2 ppm). Potential steps were applied to the Pt disk from $E_0$, at which Br- is fully desorbed, to more positive values, $E_{ads}$, at which Br- undergoes adsorption, while monitoring both the currents at the disk, $i_{disk}$, and at the ring, $i_{ring}$, with the ring polarized at a potential at which H2O2(aq) oxidation proceeds under diffusion-limited conditions. The results obtained, assuming the ORR does not interfere with Br- adsorption, made it possible to correlate $i_{disk}$ and $i_{ring}$ with the coverage of adsorbed Br-, $\theta_{Br}$, and $E_{ads}$. As evidenced from the data collected, significant drops in the diffusion-limited currents for O2 reduction derived from the presence of 10 ?M KBr could only be observed for coverages of $\theta_{Br} > 0.25$ regardless of $E_{ads}$. Similar measurements involving the same Pt(poly) rotating disk electrode performed in 1 mM H2O2 in deaerated 0.1 M HClO4 devoid of O2 displayed a similar trend. This behavior was found to be consistent with a simple blockage of surface active sites by adsorbed bromide, as predicted by the attenuation model proposed by Levart.
This study examined the effects of viewing gesture on the construction of spatial intelligence mental models. Previous research has mainly focused on gesture production, and its beneficial nature to the producer, while little research has primarily focused on if viewing gesture aids in comprehension. The present study looked to see whether viewing gesture had a positive effect on the viewer's comprehension of the problem at hand, and successfully answering the problem. We expect that the results will show that utilizing gesture does help construct mental models and yields a higher number of correct responses.
The chemistry of cyclometalated gold(III) has been relatively slow to emerge, but recent advances in catalyst and material design have driven a renewed interest. Reported here are synthetic, structural, and optical studies of cyclometalated gold(III) aryls. The new complexes show ligand-centered luminescence that is perturbed by the heavy-atom effect of gold. Palladium-catalyzed Suzuki-Miyaura reactions have been used to attach aryl ligands to gold(III); the resulting complexes were chemically and optically characterized. In related work, luminescent derivatives of a gold(III) chloro precursor, initially reported for catalytic purposes, are being prepared through boron transmetalation reactions. Alkynyl and aryl derivatives are sought. The available new complexes show ligand-centric luminescence that is perturbed by the heavy atom effect of gold. Several new complexes have been crystallographically characterized.
Aging changes in aqueous humor dynamics and ocular biometrics of SPARC null mice

Purpose: SPARC (secreted protein, acidic, cysteine rich) null mice have low intraocular pressure (IOP). Lowering IOP is the only way to treat glaucoma. This study investigated the effects of SPARC deletion on aqueous humor dynamics (AHD) to understand IOP regulation in the eyes of aging mice.

Methods: Studied were SPARC wildtype (WT) and knockout (KO) mice of three age groups (a, 4-8 weeks; b, 3-5 months; c, 20-28 months). AHD measurements included intraocular pressure (IOP) by rebound tonometer, aqueous flow (Fa) by a modified fluorophotometer and outflow facility (C) by a multi-level constant pressure perfusion method. Anterior segment optical coherence tomography (AS-OCT) was used to determine central corneal thickness (CCT) and anterior chamber depth (ACD). AS-OCT images were segmented semi-automatically to determine the volumes of the cornea (Kv) and anterior chamber (ACv).

Results: Key findings include; 1. Lower IOP in young KO mice compared to WT counterparts. This difference is lost with aging, 2. Thicker central corneas in young KO mice compared to WT mice, 3. Absence of aging associated reduction in Fa in KO mice, 4. Aging associated decrease in Fa, increase in C and AC deepening with unchanged IOP in WT mice.

Conclusion: Deletion of SPARC abrogates the normal aging changes seen in WT mice. Absence of these aging changes along with development of cataracts in all KO mice eventually fails to keep IOP lower than in WT mice. In KO mice, an increase in ACv with no accompanying changes in ACD indicates that the peripheral AC might be widening secondary to loss of lens volume from leaky mature cataracts. The lower IOP of young SPARC KO mice cannot be explained by outflow facility or by corneal changes. Since collagen I is a major structural component of the cornea and sclera, biomechanical factors might affect measured IOP. These findings support the conclusion that SPARC plays a role in normal physiologic changes that maintains IOP with aging.
The effect of molecular geometry on surfactant effectiveness in mixed solvent systems

Abstract
The surface activity of linear surfactants in ethanol-water solutions is studied with surface tension experiments and molecular dynamics simulations. The tendency of linear surfactants to partition to the surface at the infinite dilution limit is evaluated by calculating free energy profiles. Results show that the length and the width of surfactants have distinct effects. Increasing surfactant length increases the surface activity of surfactants at low ethanol concentrations. The surfactant length, however, has insignificant effect on the surface activity at high ethanol concentrations. The concentration range where the surfactant is effective is independent of surfactant length. On the other hand, increasing surfactant width increases the surface activity at all concentrations of ethanol. This allows the surfactant to be effective at higher ethanol concentrations.
Cardiac myosin binding protein-C (cMyBP-C) phosphorylation is a key regulator of contractile function, however, its contributions to length-dependent (SL) changes in cross-bridge (XB) kinetics is unknown. Therefore, we performed mechanical experiments to quantify contractile function in detergent-skinned ventricular preparations isolated from wild-type (WT) hearts, and hearts expressing non-phosphorylatable cMyBP-C (Ser to Ala substitutions at residues Ser273, Ser282, and Ser302 (i.e., 3SA)), at SL 1.9µm or 2.1µm, prior and following protein kinase A (PKA) treatment. Steady-state force measurements revealed a blunting in the length-dependent increase in myofilament Ca²⁺-sensitivity of force generation (pCa50) following an increase in SL in 3SA myocardium compared to WT myocardium. Dynamic XB behavior was assessed by imposing an acute stretch of 2% of initial muscle length, and measuring both the magnitudes and rates of resultant phases of force decay due to XB detachment and delayed force rise due to recruitment of XBs with increased SL (i.e., stretch activation). The magnitude (P2) and rate of XB detachment (krel) following stretch was significantly reduced in 3SA myocardium compared to WT myocardium at short and long SL, and prior to and following PKA treatment. Furthermore, the length-dependent acceleration of krel due to decreased SL that was observed in WT myocardium was abolished in 3SA myocardium. PKA treatment accelerated the rate of XB recruitment (kdf) following stretch at both SL’s in WT but not in 3SA myocardium. The magnitude of the entire delayed force phase (Pdf) was significantly lower in 3SA myocardium under all conditions, in part due to a reduced magnitude of XB detachment (P2) in 3SA myocardium compared to WT myocardium. These findings demonstrate that cMyBP-C phospho-ablation regulates SL- and PKA-mediated effects on XB kinetics in the myocardium, which would be expected to contribute to the regulation of the Frank-Starling mechanism.
Abstract

The purpose of this research is to compare groups of medical students who have access to Surface Hub technology to medical students who do not have access to Surface Hub technology and only traditional white boards on their group interaction in the Case Inquiry course and subsequent performance on examinations. The overarching purpose is to determine if technology impacts the group process for the benefit of the students. This research is a mixed methods, pilot study that is expected to provide insight into further, more detailed exploration of the group and technology interactions.

Data from the observations of Surface Hub usage and digital copies of white boards will be analyzed qualitatively, while the survey will provide some quantitative data for analysis. Similarly, student scores on examinations were compared to determine if technology had an impact on student performance.
The purpose of this research project is to gain student perspectives on the active learning initiatives recently implemented at CWRU, in order to help guide the University in creating new learning spaces as well as provide feedback on active learning strategies employed by faculty in traditional and active learning spaces.

Active learning is a type of instruction that requires students to engage with materials and processes relevant to the course subject matter during class time. It stands in contrast to courses focused on more passive modes of instruction in which students spend classroom time listening to lectures and taking notes. Problem and project based courses are examples of active learning environments. They promote small group work, solving complex problems, formative and peer evaluation, community building, and reflection.

This research describes active learning based on feedback from faculty and students as it relates to student engagement and success.
An Ultra Low Power Transceiver for Wireless Sensor Network Application

Abstract

It is generally believed that the next generation of the systems will be tiny, run on low power batteries and capable of being connected to the internet and provide reliable important data. Thanks to these systems we will be able to enhance the quality of life. In our project, we design the whole system on a chip which will be operated in 0.5V battery. The system is capable of sensing different sensor data and inform other sensors by a transmitter. The system is capable of run for several years without battery replacement. To go further, energy harvesting systems make these systems to run without the battery. Finally, there will be lots of different nodes available of sensing, reading and transmitting vital information about the environment.
Fly ash is a byproduct of coal burning plants at a rate of 90,000,000 tons a year. This marlal is usually discarded into landfills, but if the fly ash is incorporated with fiberglass and polyurethane, it has the potential to become extremely useful in everyday life. Before this polymeric matrix can be used, the long term degradation mechanisms of polyurethane must be identified. Using ASTM standard degradation tests, the polymer matrix will be systematically exposed to UV radiation, temperature fluctuation term degradation mechanism. It was found that UV radiation was the most effective degradation mechanisms that caused curing and surface changes that were examined by Scater Master. Colorimetry was used to determine that the oxidation is a major reason for the color changes. The FTIR data was inconclusive but did show a unique pattern. Overall the data leads us to believe that we need further investigation of the degradation phenomenon before this polymer can be modified for commercial use.
Oxygen tension is one of the most significant factors to simulate physiologically realistic microenvironment in vitro as cellular functions and behaviors are affected by the change in oxygen tension. Control of oxygen level is necessary for in vitro experiments and, so far, hypoxic chambers and workstations, which are bulky and inconvenient for the user, have been used to realize this control. However, the advancement of microfluidic technology has facilitated development of new portable devices to mimic physiological conditions such as oxygen tension, fluid flow, and shear stress. Soft-lithography-based microfluidic platforms have been widely utilized due to rapid prototyping capabilities and low-cost material requirements, mainly with polydimethylsiloxane as it is biocompatible, highly gas-permeable, and optically transparent. Despite these favorable properties, soft-lithography-based microfluidic platforms also pose critical shortcomings such as labor-intensive fabrication processes in cleanroom facilities and low throughput, which limits clinical applicability. To overcome these challenges, we have developed a high throughput, low-cost, single use, clinically applicable, easily implementable, and portable micro-gas exchanger integrated with a lamination-based microfluidic chip, which can impose a variety of physiological conditions to study biophysical properties of cells. We utilized the developed microfluidic system which is disposable after use to study RBC adhesion in 45 whole sickle cell disease (SCD) patient blood samples under hypoxic conditions. Using micro-gas exchanger technology, we found a heterogeneity in individual patient’s response to hypoxia in terms of increase in number of adhered RBCs compared to normoxic conditions. Furthermore, we observed, for the first time in the literature, associations between SCD patient blood samples responsive to hypoxia and clinical phenotypes, including increased LDH and reticulocytosis.
In this study, a previously developed three-dimensional transient numerical model was used to simulate upward flame spread in normal gravity over a thin composite solid fuel (75% cotton and 25% fiberglass). The model assumes a two-step reaction for the solid pyrolysis process. The current study reveals a flame splitting phenomenon. After ignition, the flame grows longer, narrows in the center, and then splits into two flames. After splitting, two flames propagate separately with different spread rates. This flame splitting phenomenon has been previously observed experimentally, but to the authors' knowledge was numerically captured for the first time in this study. The numerical results indicate that the two-step pyrolysis mechanism is responsible for this flame splitting. As a comparison, flame spread in a reduced pressure environment, without splitting, is also presented.

Understanding flame ignition and spread processes can help us assess fire hazards and prevent fires. A previously observed flame splitting phenomenon was further researched in this study due to its significance on understanding flame spread process. By applying a recently developed two-stage solid pyrolysis model, flame splitting phenomena was the first time captured by numerical simulation.
Transforming Growth Factor-?1 Sustains the Survival of Foxp3+ Regulatory Cells during Late Phase of Oropharyngeal Candidiasis Infection

As CD4+CD25+Foxp3+ regulatory T cells (Tregs) play crucial immunomodulatory roles during infections, one key question is how these cells are controlled during antimicrobial immune responses. Mechanisms controlling their homeostasis are central to ensure efficient protection against pathogens, as well as to control infection-associated immunopathology. Here we studied how their viability is regulated in the context of mouse oropharyngeal candidiasis (OPC) infection, and found that these cells show increased protection from apoptosis during late phase of infection and reinfection. Tregs underwent reduced cell death because they are refractory to T cell receptor restimulation-induced cell death (RICD). We confirmed their resistance to RICD, using mouse and human Tregs in vitro, and by inducing ?-CD3 antibody-mediated apoptosis in vivo. TGF- ?1 in promoting Tregs viability, coinciding with the pronounced immunomodulatory role of these cells during later phase of OPC infection, and possibly other mucosal infections.
Ultrasound (US) and magnetic resonance (MR) are two well-established imaging modalities with largely complementary contrast mechanisms. Because of their complementary contrast mechanisms, physicians will often perform both imaging techniques separately. Despite the known advantages to the combination of ultrasound and MRI data, we are unaware of any low-cost, portable system which integrates the two. We propose and begin the construction of a fundamentally new tool; a miniaturized two-dimensional (2-D) US collocated with a three-dimensional (3-D) single-sided MR system for bimodal imaging in portable or wearable form factors. The proposed system will be capable of scheduling both measurements in real-time, thus enabling closed-loop operation in which the output of one sensor is used to optimize the operation of the other. The end goal is to develop a system which combines ultrasound, MRI, and data processing into one unit. Previous work shows the feasibility of such a system and shows preliminary experimental results obtained by combining a commercial US imaging system with a custom single-sided planar one-dimensional (1-D) MR sensor. In this presentation, we design, construct, and test a 3-D, single-sided planar, MR imaging system. In addition, we began developing and testing a separate ultrasound system to be integrated with the MR system.
The commercial building sector consumes approximately 37% of U.S. electricity, accounts for a fifth of total U.S. energy consumption, and 30-50% of this energy is lost through inefficient operation. Energy audits have become an essential component to building energy management, however typical audits are costly, expensive, and inaccurate. EDIFES has already proven its ability to determine building energy signatures, identify major energy systems, and create high fidelity recommendations that result in substantial cost and energy savings and feature low return on investments (ROI).
Abstract

This study details the analysis undertaken to design a novel model of social intervention in the area of children and family services. Known as Social Investment Bonds or Pay-for-Success (PFS) contracts, these models of social policy intervention exhibit an innovative financing and contracting structure. As established in a PFS contract, investors provide up-front funding for a project. Only if successful outcomes are achieved, the government pays investors the contracted amount. PFS deals rely on research to define the target population, quantify the anticipated fiscal savings and evaluate the impact. In this poster, we report on the research related to the first county level PFS project in the US. The Cuyahoga County, OH PFS provided an evidence-based program of services to homeless families with children in foster care.

Methods: An initial exploratory analysis involved probabilistic matching of caregiver records of children in Out of Home Placement (OHP) with records from other service agencies, such as juvenile court, jail, and homeless services. We performed Cox Proportional Hazard Model analyses on the integrated data in order to identify risk factors associated with longer times in foster care. This analysis was used to identify a high-cost target population and to estimate the potential cost savings due to intervention. We also designed the randomized experiment needed to estimate a treatment effect (reduction in OHP days) in the presence of censoring and potential attrition bias and to estimate the size of the sample needed to identify a change in OHP large enough to trigger payments by the County.

Results: The experience of homelessness was found for 8% of OHP entrants, (homeless spell median=137 days; mean= 321 days). The hazard model confirmed that OHP duration was longer for children when the family experienced a homeless event: 710 as compared to 442 days at the median. Thus, the duration ratio of families with a homelessness event to those without such event is 1.6 at the median. This difference persists at the 25th percentile (1.5) and at the 75th percentile (1.3). Given these results and calculating that the average cost of an OHP day was $75, we estimated that the treatment for these families would be considered successful if reduced OHP days by 25%.

Since the randomization was to be implemented at the caregiver level, while the treatment effect was to be calculated at the child level, clustering within families had to be considered. We implemented a covariate adaptive randomization scheme to balance...
Timing of the crown placement can significantly affect the survival of endodontically treated teeth.

Preventing contamination of the root canal system between completion of endodontic treatment and restoration of the tooth is a major concern. Different studies have evaluated the quality of the restorations following root canal treatment (RCT) and highlighted the importance of full coronal coverage on the clinical success and survival of posterior teeth. However, the effect of crown placement timing after RCT on tooth survival is not well known. Objective: to investigate if the period of time between RCT and final crown placement affects the long-term survival of the tooth. We hypothesized that the shorter the time-lapse between RCT and crown placement, the more likely the survival. Comprehensive computerized analysis was performed for all patients who received RCT and crowns from 2008-2015 in graduate endodontics. Data collected included dates of RCT, crown placement, and if extracted. There were two groups: 1) receiving crown before 3 months 2) after 3 months following RCT. Data was analyzed using Multinomial Logistic Regression(?=0.05). Teeth which received crowns more than 3 months following RCT were 2.17 times more likely to be extracted compared to teeth crowned within 3 months or less(P=0.045,EXP(B)=2.17). Teeth that were extracted had a mean critical time-lapse of 4.1 months. However, those that survived had a critical time-lapse of 2.66 months. Timing of the crown placement can significantly affect the survival of endodontically treated teeth. Patients may benefit by maintaining their natural dentition, which may have otherwise been extracted and replaced by implant due to any delay in crown placement.
Copper is an essential micronutrient for the growth of flora and fauna; however, higher levels of copper (Cu II) from agricultural and other industrial waste are highly toxic to humans. The US EPA stipulates that copper in drinking water should not exceed 0.65 mg/L. Current strategies to remove copper from effluent streams involve chemical precipitation, ion exchange and filtration. While these strategies are successful, they are, in general, expensive and inefficient especially when the copper levels are low (e.g. semiconductor industries). The goal of this project is to evaluate microalgae S. Chlorella biomass as a low-cost option to remove low levels of copper through biosorption in aqueous solutions. Cultured and oven-dried S. Chlorella biomass was used to remove copper solutions of various copper concentrations and at various pH. Copper removal was evaluated colorimetrically. Our results show that the algae biomass is very effective at removing copper from both high (10 g/l) and low (1 g/l) concentration solutions. The biosorption was found to be a function of solution pH (lower pH has a lower absorption capacity) and contact time. Further, S. Chlorella was shown to absorb 100% copper equivalent to its weight. Collectively, our results show that S. Chlorella biomass biosorption is a promising low cost strategy in removing copper from effluent streams.
An integrated low-power analog front-end (AFE) for simultaneously detecting electrocardiogram (ECG) and respiration rate (RR) is designed. A low-power low-noise preamplifier is designed to amplify both the ECG and RR signals. A current-driven passive mixer is used in the RR path to upconvert the RR signal so that the ECG signal can be filtered out. The modulated RR signal is then down-converted to baseband to be further amplified and detected. Quadrature (I and Q) drive signals for the mixers are generated on-chip from an external 20 kHz clock signal. The receiver is fabricated on the OnSemi 0.5 um CMOS process. Both simulation and preliminary measurement results verify the functionality of this work. The overall gain for the ECG and RR signals are 40 dB and 70 dB respectively, and the circuit draws 6.2 μA from a 3 V power supply. This is the first work in the literature that shows integrated RR and ECG signal detection with such low power consumption.
Abstract

Aim: Cancer-related pain cancer has been associated with poorer wellbeing. This study described cancer patients’ pain levels, pain interference, and associations with physical and psychological wellbeing.

Methods: This cross-sectional study was conducted at baseline (T1) and 7 days after baseline (T2) on cancer patients > 21 years in Botswana between June-August 2014. English and Setswana versions of the Memorial Symptom Assessment Scale-Short Form (MSAS) and its Global Distress Index (GDI), Psychological (PSYCH), and Physical (PHYS) subscales, validated in Setswana in previous studies; PROMIS Pain Interference-SF8a Scale (PI), and Visual Analog Pain Scale (VAP), were used. Frequencies, percentages, measures of central tendency and dispersion, and Pearson product moment correlations were calculated.

Results: Twenty-five patients participated; 18 (72%) female; common cancers were gynecologic (n=7, 28%) and breast (n=7, 28%). Average age was 44.7 (12.4) years. Thirteen (52%) and 12 (48%) participants reported pain > 4/10 at T1 and T2, respectively; after administration of pain medications 13 (52%) participants still reported pain > 4/10 at both T1 and T2. Correlations between VAP and PI at T1 were r=.70, p<.001, and at T2 were r=.721, p<.001. VAP did not correlate with GDI or PSYCH. PI correlated with GDI (r=.56, p=.004) and PHYS (r=.48, p=.016) at T1 and GDI (r=.53, p=.007) and PHYS (r=.61, p=.001) at T2. PI did not correlate with PSYCH at T1 or T2.

Conclusion: A majority of patients report uncontrolled distressing cancer pain that interferes with physical, though not psychological, wellbeing. Routine pain assessment and a national cancer-pain plan are recommended for cancer care in Botswana.
Finding The Effect and Optimistic Doses For M.A. To Treat The HIV Virus

Our lab works on how RNA methylation impacts gene expression and reactivation of latent virus. We use two drugs that either inhibit or promote RNA methylation, and examine how they impact HIV gene expression. We treat HIV-latently infected human T-cells in the presence or absence of the two drugs respectively, and stimulate the cells with TNF-alpha, an agent that induces HIV reactivation from latency. We then measure the viral mRNAs by quantitative real-time RT-PCR, and conduct Western blot analysis to examine viral protein expression.

Human immunodeficiency virus (HIV) is a retrovirus, which infects CD4+ lymphocytes (T cells) and results in AIDS. HIV becomes a latent virus in resting T cells, which cannot be targeted by highly active anti-retroviral treatment. Current medicines for HIV only target active viral replication. Our lab works on how RNA methylation impacts gene expression and reactivation of latent virus. We use two drugs that either inhibit or promote RNA methylation, and examine how they impact HIV gene expression. We treat HIV-latently infected human T-cells in the presence or absence of the two drugs respectively, and stimulate the cells with TNF-alpha, an agent that induces HIV reactivation from latency. We then measure the viral mRNAs by quantitative real-time RT-PCR, and conduct Western blot analysis to examine viral protein expression.
Previous studies indicate that flames tend to spread faster in some discrete fuel configurations than in continuous configurations. While these previous experiments identified this phenomenon, there are few, if not zero, numerical studies that offer comprehensive investigation of what causes it. In this study, upward flame spread over thin solid fuel is numerically examined in discrete and continuous fuel configurations using Fire Dynamic Simulator. In the discrete configuration, fuel segments (with length ranging from 1cm to 5cm) are separated by air gaps. The presence of the gaps has two effects. First, it forces the flame base to jump to the next fuel segment when the upstream one burns out. Second, it reduces the flame standoff distance at the gaps, and in some configurations, breaks the flame into multiple flamelets. The shorter standoff distance and intense burning at each flamelet base result in a larger total burning rate for the discrete fuel array, compared with continuous fuel. These two effects contribute to the faster flame spread over discrete fuel configurations. A parametric study of the fuel-gap length ratio is also presented in this study.
Dentin sialophosphoprotein (DSPP) is critical for proper mineralization of tooth dentin, and understanding how it is regulated should yield important insights into how dentin biomineralization is controlled. Regeneration of dentin tissues in the pulp space of teeth serves the ultimate goal of preserving teeth. The aim of this study was to investigate if human beta-defensins could activate the expression of the dentin sialophosphoprotein gene in stem cells of human exfoliated deciduous teeth.
Introduction and Objectives
Diabetes prevalence is rising rapidly in the population of Asian Americans (AAs) in the US. In 2000, 3.5% of AAs were diabetic, a smaller percentage than blacks (7.3%) and whites (4.1%). However, in 2012, the prevalence of diabetes among Asian Americans increased to 9.0%, lower than blacks (13.2%), but higher than whites (7.6%).

The objectives of this project are to identify the risk factors for diabetes among AAs, including social, economic, physiological and demographic factors that are associated with high prevalence of diabetes among AA. This project also aims to inform effective strategies and interventions for health professionals to better control the rising diabetes rate among AAs.

Approach
The 2012 Behavioral Risk Factor Surveillance System (BRFSS) was used for analysis, and SPSS 22 was used to identify the pattern of diabetes among AAs by age, gender, health insurance, BMI, physical activity in last 30 days, and diabetes education. Multivariate logistic regression will be used to identify whether these variables are significantly associated with the risk of developing diabetes among AAs.

Results
In total 726 Asian Americans took the survey. About 9.8% of the participants have been told by a doctor that they have diabetes, and 8.7% have pre-diabetes. The average age was 40.3 years old (range: 9-94, SD = 16). The average BMI is 26.36 (Range: 12.99-56.64, SD = 5.68). In addition, 83.3% have had physical exercise in last 30 days and 87.2% have health care coverage. Also, about half (48%) of those with diabetes had taken a course or class on how to self-manage their diabetes.

The multivariate model is significant with ?2=54.9 (p<0.001). The model found that the risk of developing diabetes among AAs is significantly associated with age range 35-54 and 55 and above, body mass index (BMI) range 18.5-less than 25, 25- less than 30 and 30 and above, and having been told to have pre-diabetes. The risk decreases with having health care coverage and
Introduction: Mechanical preparation and restoration are known to have deleterious effects on the dental pulp with heat generation, remaining microorganisms within the dental tubules and internal stresses. The amount of remaining dentin thickness (RDT) can be a determinant factor in the diagnosis of symptomatic irreversible pulpitis (SIP), asymptomatic irreversible pulpitis (ASIP) and pulpal necrosis. Hypothesis: We hypothesized that the amount of remaining dentinal thickness would be significantly different between SIP and pulpal necrosis. Objective: To correlate SIP and necrotic pulp to RDT in teeth presenting for root canal therapy. Materials and Methods: Dental records of all patients who received non-surgical root canal treatment in the graduate endodontic department were included in this 5-year retrospective study. A total of 708 patients’ records were used in this study. Inclusion criteria: radiographs of diagnostic quality showing the pulp chamber and posterior teeth only. Precise radiographic measurements were made from the restoration to the closest point of the pulp chamber using Infinity software. Differences between groups were statistically analyzed by ANCOVA to adjust for variables using SPSS software. Results: The mean dentinal thickness of symptomatic irreversible pulpitis, asymptomatic irreversible pulpitis and pulpal necrosis was 1.6, 1.1 and 0.7mm respectively. Differences between mean symptomatic irreversible pulpitis and pulpal necrosis were statistically significant (p=0.035). No significant difference between SIP and ASIP, necrotic and ASIP groups (p=0.07) Conclusion: The results suggest that deep restorations and less then 1mm of RDT can be associated with pulpal necrosis.
The Effect of Currently Existing Crown, Amalgam or Composites on Endodontic Periapical Diagnosis in Teeth Prior To Root Canal Treatment

Periapical diagnosis of teeth prior to root canal treatment (RCT) can affect the treatment prognosis. Evaluation of the periradicular status prior and subsequent to restorative treatments is also crucial. Studies have suggested that teeth with full crowns may be more associated with apical periodontitis (SAP) compared to other restorations. Considering inclusion and exclusion criteria, 708 teeth with previous restorations of composite, amalgam or crowns, which later needed RCT at the graduate endodontic department were included in this 5-year retrospective study. Data collected were types of the restoration: amalgam, composite or crown; periapical diagnoses: normal, SAP, asymptomatic apical periodontitis (ASAP), acute apical abscess (AAA) and chronic apical abscess (CAA) at the time of RCT. Data was statistically analyzed using Multinomial Regression ($\alpha=0.05$). Results: Cramer’s V test showed a moderate association between type of restoration and periapical diagnoses ($c=0.58, P=0.04$). Teeth restored with PFM crowns were diagnosed with SAP 4.3 times more than those with amalgam and 3.2 times more than those with composite ($P=0.001, \text{EXP}[B-\text{Amalgam}]=4.3, \text{EXP}[B-\text{Composite}]=3.2$). Inappropriately treatment planned crowns in lieu of more conservative restorations could unnecessarily impact periapical integrity and prognosis of RCT. Therefore, teeth restored with crowns requiring RCT may need adjunctive antimicrobial therapy.
The multicellular tumor spheroid (MCTS) is currently the most widely accepted 3D in vitro tumor model. MCTS can mimic in vivo tumor tissue microenvironment and can be used as a predictor for pharmacodynamic and drug efficacy studies in animal models. Despite of its recognized value, however, MCTS is still not widely implemented in drug development. This is because fabricating MCTS requires time and deriving practical data from the MCTS experiments is ambiguous, except information on lumped cell death after exposure to drugs. We have developed a novel tumor tissue model that shares basic morphology and internal features with the MCTS. This new model allows us to view into the spheroid to map drug penetration and oxygenation. It is low labor and can be applied in high throughput systems.

Key Words
3D in vitro tumor model
drug penetration
tissue engineering

Abstract

The multicellular tumor spheroid (MCTS) is currently the most widely accepted 3D in vitro tumor model. MCTS can mimic in vivo tumor tissue microenvironment and can be used as a predictor for pharmacodynamic and drug efficacy studies in animal models. Despite of its recognized value, however, MCTS is still not widely implemented in drug development. This is because fabricating MCTS requires time and deriving practical data from the MCTS experiments is ambiguous, except information on lumped cell death after exposure to drugs. We have developed a novel tumor tissue model that shares basic morphology and internal features with the MCTS. The proposed model can be made with low labor costs and can be implement for high throughput studies. The new model resembles a half of a conventional MCTS that we call "Multicellular tumor hemi-spheroid", MCTH. The MCTH and MCTS share the same nutrient and oxygen transport patterns as well as drug penetration due to the similarity in the geometric shape. More importantly the flat equatorial surface of the MCTH can be used as a window into the inside of the tumor model. With this key feature drug penetration can be mapped, and oxygenation can also be quantified non-invasively. This presentation describes the process of MCTH fabrication, tumor microenvironment staining using Trypan blue assay and drug penetration using a classical small drug molecule, doxorubicin, for validation. Mcf-7 and NF-639 cells are used in the tests.
Background: Superimposition of cephalograms has many uses in orthodontics, including growth evaluation and outcome assessments, but cephalograms are distorted and show incomplete two-dimensional data. Cone Beam Computed Tomography (CBCT) provides a three-dimensional undistorted and more complete analysis of our patients. Superimposition of 2 CBCT’s is possible by using landmarks, surfaces, or density information (voxel-based). Voxel-based superimposition is automated and uses the most image content, providing the most accurate result. Until recently such superimposition was extremely laborious, but a user-friendly voxel-based superimposition has recently been introduced. Aim: to evaluate the accuracy and reliability of Dolphin 3D voxel-based superimposition. Methods: This was a retrospective study using existing scans of 31 surgical orthodontic patients. The sample included 19 females and 12 males with a mean age of 21. Each patient had a pre-surgical (T1) and a post-surgical (T2) scan taken within 12 months. Surgical patients were used due to lack of expected growth, to reduce outcome bias. The volumes were superimposed using voxel-based methods from Dolphin Imaging Systems and the accepted method used by Cevidanes et al. The Cevidanes method, considered as the gold standard, uses 2 different open-source programs, and takes about 3 hours to complete, while the Dolphin method takes under 5 minutes. T2 was superimposed on T1 cranial base. T2 registrations for both methods were compared to each other using the absolute closest point color map, with emphasis on 7 regions (Nasion, A point, B point, bilateral Zygomatic, and bilateral Gonion). Results: Intraclass correlation showed excellent reliability (0.96). The mean differences between the two methods were less than 0.21mm (voxel size=0.38). The least difference was in the left Zygomatic area with 0.09mm±0.07, while the largest was in the Right Gonion region with 0.21mm±0.13. Conclusions: Dolphin 3D voxel-based superimposition, a fast and user-friendly method, is accurate and reliable.
The Association of Various Restorative Modalities with the Differential Endodontic Pulpal Diagnosis of Teeth Prior to Endodontic Intervention

Abstract

Stressed pulp syndrome (SPS) describes a vital dental pulp that has been subjected to repeated damages such as operative procedures. SPS should be considered prior and subsequent to any restorative treatments as new restorations may exacerbate the current status of the pulp. These repeated damages are believed to jeopardize the repairing ability of the pulp. Purpose: To associate various restorations with different pulpal diagnoses in teeth that require nonsurgical root canal treatment (NSRCT). Hypothesis: We hypothesized that teeth restored with crowns will be significantly associated with pulpal necrosis (PN). Dental records of all patients who received NSRCT in the graduate endodontic department from 2009-2014 were reviewed in this retrospective study. Data included were types of restoration: composites, amalgams, and PFM crowns; pulpal diagnoses: symptomatic irreversible pulpitis (SIP), asymptomatic irreversible pulpitis (ASIP), PN; age and gender. 800 teeth requiring NSRCT that were restored with composite, amalgam or crowns were included. Data were analyzed using Multinomial Regression using SPSS (?=0.05). Cramer’s test showed a strong association between the types of restoration and pulpal diagnosis (c = 0.73, P = 0.001). Teeth restored with PFM crowns (74% PN, 24% SIP, 2% ASIP) were diagnosed with PN 7 times more than those with amalgam (42% PN, 44% SIP, 14% ASIP) and 4.5 times more than those with composites (56% PN, 33% SIP, 11% ASIP) [P = 0.01, EXP(B-amalgam) = 7, EXP(B-composite) = 4.5]. Teeth restored with composite are 2.8 times more likely to be necrotic at the time of RCT compared to amalgam (P = 0.01, EXP(B) = 2.8). Dentists should perform pulp vitality testing before, during and after all restorative treatment. This will save time and costs for patients by preventing the compromise of a new restoration and/or the need for an additional restoration.
Conventional aqueous redox flow battery (RFB) technology is limited by low energy and power densities; thus, recent focus has been on non-aqueous electrolytes. Although organic solvents allow for increased voltage windows, they possess a several drawbacks, including sensitivity to moisture, low solubility of active species, and high flammability and toxicity. Thus, another class of solvents, ionic liquids (IL) offer a “greener” alternative to volatile organic electrolytes as they are non-toxic and nonflammable [1, 2]. These “designer solvents” can be created using a number of combinations of bulky asymmetric cations and weakly coordinating anions, allowing for the ability to tailor different electrolyte properties.

Iron chloride based IL electrolytes containing up to 6.3 M iron have been synthesized. It was found that electrolyte conductivity and viscosity, as well as the nature of the electroplated iron, are greatly influenced by electrolyte composition. An electrolyte containing iron chloride, choline chloride, and ethylene glycol in a 1:1:4 molar ratio was favored due to its high plating efficiencies and fast kinetics [3]. Electrochemical reactivity of the solute ions as well as the physical properties of the electrolyte are controlled by speciation of the metals in solution. Characterization of chemical speciation is being investigated using X-ray absorption spectroscopy (XAS) techniques as a means to understand what ions are responsible for the observed properties in these iron IL electrolytes.
Malnutrition’s Role as a Fall Risk Factor

Falls and falls related injuries are often a devastating event for older adults. Several assessment instruments to assess and mitigate risks for falls have been developed. However, nutritional risk factors such as weight loss, anemia and vitamin D levels have not been adequately addressed.

This retrospective chart review study (n= 120) assessed the relationship between weight loss, hemoglobin decline and vitamin D deficiency in single and multiple fallers among older veterans.

In all fallers, percent weight loss in the months prior to the documented fall was greater in multiple event fallers than in single event fallers. For all fallers, weight loss in the one month prior to the first fall was correlated with the incidence of recurrent falls (p= 0.004). For all fallers, there was a significant decline in Hgb levels, in both single event fallers and frequent fallers, at 12 and 6 months prior to the first fall (95% CI, p < 0.000).

In individuals without dementia, greater weight loss was significantly associated with an increased number of falls (n=55, p=0.0147) at 12 months. For individuals without dementia, no difference was detected in hemoglobin status at 12 months (n= 48, p=0.4118), between single event fallers and multiple fallers.

For individuals with a documented diagnosis of dementia, malnutrition was a greater risk factor among multiple fallers, but not in single event fallers (n=55, p=0.0028). Weight loss, hemoglobin and Vitamin D status were found to be similar between the single and multiple fall groups (p>0.05).

Weight loss alone increased the risk of multiple falls in individuals without dementia. In those with dementia, weight loss plus decline in Hemoglobin values increased the risk of multiple falls. Further research is needed to develop fall risk screening tools and interventions that address these nutritional risk factors for falls.

Objective 1: “After attending this session participants will be able to...” : identify nutritional risk factors that are associated with single and multiple falls.

Objective 2: “After attending this session participants will be able to...” : recognize nutritional risk factors identified in older veterans with a history of dementia and falls.
Abstract

This poster visualizes the mutated version of extremely fast polynomial time algorithm, NOVCA (Near Optimal Vertex Cover Algorithm). NOVCA is based on the idea of including the vertex having higher degree in the cover. Mutation is introduced in NOVCA by randomly selecting any remaining vertex having degree greater than 1 in the cover as an exception.
The aim of endodontic therapy is to maintain tooth function and prevent periapical disease. Various factors have been shown to affect the survival of root canal treated teeth (RCTT). However, the effect of the opposing dentition has not been thoroughly investigated on the survival of RCTT. It has been suggested that RCTT opposing natural dentition are associated with a significantly lower survival rate compared to those opposing a fixed partial denture (FPD). Objective: To verify if different types of opposing dentition might affect the survival of RCTT. Hypothesis: We hypothesized that the presence/type of opposing dentition would affect the survival of RCTT. In the present cross sectional retrospective study, 400 RCTT restored with crowns were included from a computerized analysis of dental school patients who received root canal treatment from 2010-2015. Data collected included date of root canal treatment, type of the opposing dentition, whether RCTT were extracted and if so, the date of the extraction. Data was analyzed using Multinomial Regression. RCTT occluding against FPD was significantly associated with 5.3 times greater chance of extraction compared to RCTT with no opposing dentition (P= 0.001, Exp(B)=5.34). However, there was no significant difference in the survival of RCTT opposing natural dentition compared to those with no opposing dentition (P=0.78). Conclusion: Based on our findings which are contrary to previous studies, it might be speculated that a well designed FPD that simulates the harmonious occlusion of natural dentition can be one of the factors that would increase the survival of RCTT opposing FPD.
### Abstract

Phase I of the Titan submarine project establishes the conceptual design of a submarine that operates in a cryogenic sea of liquid methane and liquid ethane, with dissolved nitrogen gas. These are the conditions on Saturn’s moon Titan, the only known body other than Earth in the solar system with stable liquid seas. The following design concerns will be addressed in Phase II: First, more data is needed on the solubility of nitrogen in methane and ethane; such mixing dramatically affect all aspects of the submarine operation. Any change of pressure or large thermal gradients on the outside of the sub may cause dissolved nitrogen bubbles to come out of solution near surface crevices, which may interfere with science measurements or with propeller function. Second, ballast control itself is also a fundamental source of difficulty. The baseline concept relies on a pressurized gas system to control the amount of ballast weight added or subtracted from the sub; the easiest pressurant gas to harvest for this purpose is nitrogen, from the Titan atmosphere, but under pressure at cryogenic conditions it may partly liquify and require that the system handle the two-phase pressure control of liquids and gases. Finally, the presence or absence of a density gradient in the seas could completely change the control scheme by which the submarine is operated. This presentation will discuss these issues, along with current analyses and mitigation strategies.
CRISPR/Cas9 Targeted Knock-In of TREM2 R47H Significantly Modifies Alzheimer’s Disease Pathology & Neuroinflammation in Vivo

Guerreiro et al. (2013) and Jonsson et al. (2013) identified that an R47H missense mutation in the Triggering Receptor Expressed on Myeloid Cells-2 (TREM2) confers a greatly elevated odds ratio for development of late onset Alzheimer’s disease (AD), proposed to be a loss of function mutation. Recently, Jay & Miller et al. (2015) found that homozygous TREM2 knockout in the APPPS1 AD mouse model resulted in significant attenuation of AD-like pathology and neuroinflammation at 4 months. Flow cytometry and bone marrow chimera studies suggested that plaque associated myeloid cells were infiltrating monocytes and that migration to plaques was dependent on TREM2. Finally, gene expression studies demonstrated a shift to a more beneficial anti-inflammatory profile. These data suggest that TREM2 loss of function ameliorates inflammatory processes driving AD pathology, at odds with the suggestion of R47H TREM2 as a loss of function. To further examine the role of the R47H allele in AD pathogenesis, CRISPR/Cas9 technology was utilized to generate a Trem2 R47H/+ knock-in mouse and crossed to the APPPS1 mouse model. Strikingly, Trem2R47H/+; APPPS1 mice exhibited altered levels of amyloid plaques compared to Trem2+/+; APPPS1 mice at 4 months. Moreover, inflammatory markers such as Iba1 were significantly modified, as well as accumulation of plaque-associated myeloid cells. Further experiments are needed to understand how the R47H TREM2 variant impacts myeloid cell function and will ultimately provide new insights into disease mechanisms and potential therapeutic targets for AD.

Funding Sources: NIH/NINDS T32 NS077888

Abstract
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Funding Sources: NIH/NINDS T32 NS077888
Delirium is a complex constellation of physical and psychological symptoms. Assessment and management is often difficult and stressful for caregivers. Traditional educational strategies including didactic education have not been successful in improving knowledge, attitudes and changes practice patterns. To address these gaps in education the Cleveland Louis Stokes Veterans Administration Medical Center piloted an innovative program utilizing simulation with standardized patients. A Standardized Patient (SP) is an individual trained to act as a real patient in order to simulate a set of symptoms or problems. Standardized patients have been successfully used in the education and evaluation of inter-professional providers in basic, applied and translational medical education. Interacting with SPs gives learners a chance to practice their clinical and interpersonal skills with an emphasis on communication before meeting actual patients. The team developed and delivered a simulation teaching session on delirium, to a group of 100 inter-professional caregivers. Simulated patients with hyperactive, hypoactive delirium and family members preparing for discharge were introduced to learners. Pocket cue cards were available to learners throughout the session. Coaching included a skills checklist on assessment skills, communication skills and non-pharmacological interventions. The majority (88%), of caregivers highly rated use of simulation and coaching as a relevant and effective method to increase competency. There were significant improvements in knowledge, (delirium is a medical emergency 67% to 97%, symptoms of delirium 80% to 93%, diversional activities 57% to 93%, and distraction 77% to 97%). Chart reviews validated an increase number of non-pharmacological interventions <10% to 43%.
Objective: Spinal cord stimulation (SCS) via disc electrodes surgically placed via laminotomy incisions, has been shown to restore an effective cough in subjects with SCI. The purpose of the this study is to evaluate a new method of electrical activation of the expiratory muscles to restore an effective cough utilizing spinal cord wire leads, which can be implanted with minimally invasive techniques.

Design/Method: In 2 SCI subjects, parallel wire leads with two electrode contacts were inserted percutaneously through a needle, and advanced to the T9, T11 spinal levels and connected to an implanted radiofrequency receiver. Post-implantation, each subject was instructed to apply stimulation, by activating an external transmitter, 2-3 times/day and as needed for secretion management. Stimulus parameters were set at values resulting in near maximum airway pressure generation (Paw) (30-40V, 50Hz, 0.2ms). Paw was measured at the functional residual capacity (FRC) and total lung capacity (TLC) as an index of expiratory muscle strength.

Results: Mean Paw during spontaneous efforts was 19.9±1cmH2O. Bipolar (T9-T11) SCS (40V, 50Hz, 0.2ms) resulted in mean Paw of 65±8, and 98±6 cmH2O, at FRC and TLC respectively. Monopolar (T9 only) SCS (40V, 50Hz, 0.2ms) resulted in mean Paw of 45±4, and 75±19 cmH2O, at FRC and TLC respectively. Each subject experienced much greater ease in raising secretions with use of SCS and no longer required other methods of secretion management.

Conclusion: SCS via wire leads, which can be implanted using minimally invasive techniques, may provide a new useful method to restore an effective cough mechanism and possibly reduce the morbidity and mortality associated with respiratory tract infections in patients with spinal cord injury.
Our booth will promote the various ways that the University Compliance Office can assist the CWRU research community, such as through the export compliance program and proper privacy management.
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 NIAC Phase I design of the submarine. Specifically, the trade studies for power, thermal, propulsion, and ballast control of the submarine will be presented. The current 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.
The foreclosure crisis resulted in a glut of abandoned and vacant property in many US cities. This paper analyses a possible solution to this problem, which is to re-concentrate the existing population in these cities into a set of new neighborhoods, using voluntary (i.e. subsidized) moves. The analysis shows that this program can pay for itself.
# Abstract

Cystic Fibrosis (CF) is a genetically recessive disease caused by a defective chloride channel in the epithelia that leads to the secretion of abnormally viscous mucus. This adversely affects pulmonary function since mucus buildup in airway tracts provides ideal growth environment for bacteria and will lead to chronic lung failure in the long term. It is important to diagnose the presence of CF in patients as early as possible so that treatments can begin early. The gold standard of CF diagnosis is the measurement of chloride in sweat and is typically performed at the age of 3 month or later. The test requires pilocarpine iontophoresis to stimulate the sweat glands to produce minimum 15uL of sweat in less than 30min. The collected sweat sample is then sent to a laboratory facility to analyze the amount of chloride in the sweat sample. This procedure is problematic in some newborns: 1) if not enough sweat is collected in 30min, the test has to be repeated; 2) sweat sample is susceptible to contamination or evaporation as they are delivered to the lab facility, and 3) requires expertise to perform the accurate sweat chloride analysis. We have developed a technology that can detect chloride content from 2uL of sweat sample. The technology requires two electrodes and is based on coulometric titration and potentiometric measurement. Since coulometry is absolute, calibration is not necessary. Here we describe the concept of our sweat detection mechanism, display initial work with different concentrations of NaCl solution and clinical data using actual sweat samples.
The freezing and thawing process of soil in cold regions can cause serious damage to the transportation infrastructure. This paper aims to explore two aspects of frozen soil behaviors. The first aspect aims to develop a monitoring technology for the extent of freezing and thawing, and their influence on mechanical properties. From the experimental data: 1. the freezing and thawing extent versus time; 2. the volumetric water content versus temperature and suction; 3. the mechanical properties of clay samples during the processes of thawing were determined. This effort provides a new way to quickly and accurately measure the freezing and thawing characteristics of soil, as well as the effects of thawing on the strength of the soil. This method can provide information on freezing and thawing characteristics of soil for transportation infrastructure design in cold regions. Another aspect of this research provides a microstructure based random finite element simulation model that describes the thermal-hydro-mechanical behaviors of frozen soil subjected to the freezing/thawing process. The mechanical and thermal behaviors simulated by the FEM model agree well with the experimental measurement. This provides a reliable simulation tool to predict the frozen soil behaviors during the freezing and thawing process.
Within the praying mantises (Insecta: Mantodea), taxonomists have historically relied on geographic distributional records, external morphological characters, as well as male genitalic characters, for species delimitation and higher-level taxonomy. The systematic utilization of male and female genitalia within Mantodea has been explored over the greater part of a century, with different trajectories developing between the sexes. While both male and female genital complexes within various mantodean families were shown to have superficial systematic merit in the early part of the twentieth century, the more sclerotized male genital complex was eventually favored and has since been developed into a primary taxonomic character system for the Order with female genitalia remaining largely understudied. As ambiguous and overlapping species- and higher-level boundaries occur, it is important to consider and develop novel character systems to enhance taxon delimitation, and as such we explored female genitalia as a potential site for taxonomic characters within Mantodea. To test the taxonomic utility of female genitalic characters, we investigated two genera (totaling four species) with a complex taxonomic history: Nilomantis Werner, 1907 and Ilomantis Giglio-Tos, 1915. This investigation demonstrated that female genitalic characters were able to consistently delimit generic- and species-level boundaries within our study taxa, the results of which were validated via traditional taxonomic data (i.e., geographic distributional records, external morphological characters, and male genitalic characters). Using female genitalic characters, we found evidence supporting the validity of Ilomantis, which is presently a junior synonym of Nilomantis, as well as evidence leading to the delimitation of a new species within Ilomantis. From these results, we conclude that female genitalic characters have taxonomic utility within Mantodea, which subsequently underscore the need for a more thorough investigation of female genitalia as sites for taxonomic characters across the Order. The development of a female genitalic character system will both enhance taxonomic stability and enable taxonomists to move past sexual dimorphism as a limitation to specimen determination.
Abstract

Previous studies have shown that photoreceptor cells in diabetes generate superoxide, and this leads to the increase in production of inflammatory proteins (iNOS and ICAM1) in the retina. We are investigating the hypothesis that photoreceptor cells themselves are a source of inflammatory changes induced in the retina in diabetes, and that this inflammation can stimulate induction of inflammatory cytokines and proteins in nearby cells. Laser capture micro-dissection was used to isolate photoreceptor cells from the retina of diabetic (2 months) and nondiabetic C57BL/6 mice. Results were analyzed using qRT-PCR. We also used immunohistochemistry to localize inflammatory proteins in the photoreceptors in diabetes. For crosstalk experiments, a photoreceptor cell line (661W) was incubated in 5 and 30mM glucose for 40-48 hours, and conditioned media from the cells was added to leukocytes, cultured retinal endothelial cells and glial cells. The effect of the conditioned media on inflammatory cytokines in the endothelial cells was assessed by qRT-PCR. Diabetes results in increased production of inflammatory proteins (ICAM1, iNOS, and COX2) in photoreceptor cells. Increased expression of iNOS and COX2 in photoreceptors in diabetes was demonstrated also by immunohistochemistry. From the cross-talk experiments, conditioned media from photoreceptors incubated in high glucose increased TNF-alpha mRNA in leukocytes and retinal endothelial cells, but not glial cells. Photoreceptor cells produce inflammatory proteins in diabetes and the production of inflammatory mediators by photoreceptors can stimulate other cells in the retina to contrib
Abstract

Purpose: The study purpose was to describe the characteristics and healthcare utilization outcomes (emergency room visits, rehospitalizations) of neonates following initial discharge home from a Neonatal Intensive Care Unit (NICU) dependent on medical technology such as supplemental oxygen and feeding tubes.

Research Question: What are the (a) characteristics and (b) health care utilization outcomes of neonates discharged home from a NICU dependent on medical technology?

Theoretical Framework: Meleis' Transition Theory guided this study.

Methods: This descriptive, correlational study was conducted at a large Level III NICU in the Midwest. Following IRB approval, a retrospective chart review was performed of neonates (N=71) upon initial discharge home from the NICU dependent on medical technology (supplemental oxygen, feeding tubes, tracheostomy, mechanical ventilation). Study variables included gestational age, birth weight, race/ethnicity, gender, type of technology used, total hospital length of stay, and emergency room (ER) visits and rehospitalization one year post-discharge. Analysis of neonates with 1 year post-discharge data was conducted to identify associations with healthcare utilization. Descriptive and regression analyses were performed.

Results: Approximately 40% of neonates were between 23-26 weeks gestational age, with birth weight ≤1000 grams. The most frequent technologies used were supplemental oxygen (66%) and feeding tubes (46.5%). The mean total initial hospital length of stay for technology-dependent neonates was 108.6 days versus 25.7 days for non-technology-dependent neonates. The mean total of hospital days one year following initial discharge was 21.8 days. Technology-dependent neonates who were female, with a gastrostomy tube, or with longer initial hospital length of stay were at greatest risk for rehospitalization.

Conclusion: Technology-dependent neonates require vigilant, complex care and treatment by their parents following discharge from the hospital for continued survival. The period of transition from the hospital to home is a particularly vulnerable period for the neonates and their parents. Nurses and other healthcare team members can provide needed assessment and support for technology-dependent neonates and their parents during the vulnerable transition period upon initial discharge from the hospital to home.
Within the United States, there are an estimated 1.9 million amputees and approximately 185,000 amputations surgeries performed each year. A growing problem for individuals with trans-tibial prostheses is that the shape of their limb might fluctuate over time due to interface stress fluctuations. This can lead to decreased contact between the socket of the prosthesis and the limb itself. The decreased contact with the limb causes areas of localized pressure, which can lead to discomfort and pain. Therefore, there is a need for a prosthesis in which the user can adjust the socket to conform to the shape of his/her limb. Our group has developed a self-adjusting prosthetic socket designed to read the pressures applied to the limb and inflate air compartments within the socket to relieve pressure from the limb.
Breast cancer survivors make up 41% of the 41.5 million cancer survivors in the United States. The transition from active treatment to survivorship is a critical period when survivors experience various sources and aspects of illness uncertainty and persistent treatment-related symptoms. Understanding factors that are associated with illness uncertainty will aid in developing interventions for breast cancer survivors at the transition. The purpose of this study was to examine the relationships among illness uncertainty, symptom distress, self-efficacy, and social support in breast cancer survivors.

Mishel's Uncertainty in Illness theory guided the study. This was a secondary analysis using a cross-sectional, correlational design. At the completion of definitive cancer treatment, a convenience sample of 45 breast cancer survivors were assessed for uncertainty with the Mishel Uncertainty in Illness Scale-Community. Other measures included the Medical Outcomes Social Support Survey, the Cancer Behavior Inventory for self-efficacy, and the Memorial Symptom Assessment Scale for symptom distress.

Participants were 68.9% Caucasian and 29.9% African American females with an average age of 55 years. There was a statistically significant direct relationship between uncertainty and physical symptom distress ($r = .406, p < .001$) and psychological symptom distress ($r = .627, p < .001$). Statistically significant indirect relationships were found between uncertainty and self-efficacy for coping ($r = .553, p < .001$), and social support ($r = -.563, p < .001$). Greater uncertainty in illness was associated with higher physical and psychological symptom distress, lower self-efficacy, and less social support. Demographic and medical factors were not significantly associated with uncertainty.

The findings suggest that oncology nurses have an opportunity at the immediate transition to post-treatment survivorship to reduce uncertainty by implementing interventions targeting symptom distress, self-efficacy for coping, and social support. Future studies are needed to explore the relationships among these concepts through longitudinal models and to develop transition interventions to support oncology nursing practice.
Atomic Force Microscopy (AFM) for Optimization of Corona Treatment on PET films

Atomic Force Microscopy (AFM) can be used to investigate the effect of the duration of corona treatment on the surface morphology and surface roughness. If coupled with a goniometer, it provides a complete picture of the change in surface energy and surface morphology as a function of corona treatment duration.

Corona treatment has been used by a number of industry to increase the surface energy of films, foils, paper, cloth, and polymer to improve its wettability. Increasing the surface energy improves the adhesion of water-based inks, glues, coatings, and adhesives. As a general rule, a material will be wetted if its surface energy is higher than the surface energy of the liquid. Incompatibility between surface energies can cause several problems such as poor adhesion, inability to print on it, and poor wetting. Corona treatment shifts the surface energy to higher value, and therefore contact angle to lower values, so it will be more compatible for its application. The corona plasma is generated by applying a high frequency current to an electrode array. Atomic Force Microscopy (AFM) can be used to investigate the effect of the duration of corona treatment on the surface morphology and surface roughness. If coupled with a goniometer, it provides a complete picture of the change in surface energy and surface morphology as a function of corona treatment duration.

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Phosphaalkenes (R2C=PR') represent main group analogs of alkenes (R2C=CR'2). The direction of this research is to explore ways to expand this analogy to polymers and materials having extended pi-conjugation that involves P=C units. 2-R-1,3-Benzoazaphospholes (R-BOPs)? are interesting examples of heterocyclic phosphaalkenes that exhibit high fluorescence quantum yields. This presentation will explore efforts of coordinating R-BOPs to transition metal complexes in order to aid polymerization.
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 Case Transgenic and Targeting Facility is the sole transgenic core in the Cleveland area, serving investigators at CWRU, UHCMC, CCF, the VA Hospital, Metro-Health Hospital and Kent State University. The Transgenic Facility is competitive with transgenic cores at other US academic institutions in success rates, turnaround and pricing. We were recently rated as one of the best transgenic cores in the world in an international survey. The transgenic and targeted mice we have made for our clients have been featured in over 200 peer-reviewed publications.

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 a dozen projects, and have about 20 other CRISPR/Cas9 projects at various stages of completion.

The Clinical and Translational Science Collaborative (CTSC) awards $10,000 for pilot projects using our services, including CRISPR/Cas injection. The application is a single page, submissions may be made at any time, and our clients have a high success rate in obtaining these grants.

For more information on CRISPR/Cas technology, our array of services, service fees, success rates, publications, on-line ordering, protocols, regulatory compliance, contact information and general information about mouse genetics and biology, visit
Toxoplasma gondii Activates Src and Epidermal Growth Factor Receptor (EGFR) to Promote Survival within Host Cells

Abstract
Toxoplasma gondii is an obligate intracellular protozoan that infects one third of the world population. T. gondii can cause disease in humans that manifests primarily as ocular or cerebral toxoplasmosis. Current therapeutic approaches against toxoplasmosis are suboptimal. Studying the interaction between the parasite and host cells may lead to novel approaches to treat toxoplasmosis. T. gondii survives within infected cells because it resides in a vacuole that avoids fusion with lysosomes. Autophagy is a pathway that targets organelles and portions of the cytoplasm to the lysosomal compartment. T. gondii avoids targeting by autophagosomes and as a result is not subjected to lysosomal degradation. The parasite has evolved mechanisms to prevent autophagic degradation as a strategy to promote survival within host cells. We found that T. gondii caused activation of Src in infected cells. In turn, Src mediated transactivation of Epidermal Growth Factor Receptor (EGFR). Activation of these signaling molecules was prolonged (~18h post-infection). Addition of Src or EGFR inhibitors 6 h after infection with T. gondii caused parasite killing that appeared to be mediated by autophagy. These findings open up the possibility of using pharmacologic inhibitors of EGFR and/or Src as novel approach to treat toxoplasmosis.
A Five Fold Decreased Survival of Posterior Teeth Restored with Amalgam or Composite vs. Crown Following Root Canal Treatment

By choosing more conservative restorations such as amalgam or composite in situations where crowns are indicated, practitioners may be condemning root canal treated teeth to be 5 times more likely to be extracted, devaluing the long-term viability of endodontics as a specialty.
In this study, a kind of magnetic-directed hydrogel particles with NIR-light triggered guest-release property is fabricated. Both NIR responsive polypyrrole (Ppy) nanoparticles and temperature sensitive poly(N-isopropylacrylamide) (PNIPAM) are added into this hydrogel system as functional members, which induce the release of encapsulated drug when shining NIR light onto these gel beads. And with iron oxide particles crosslinking PVA frame, these particles can 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 without unnecessary losing.
Natural products have proven to be a rich source for bioactive molecules for a wide range of human diseases, including cancer. In order to identify novel anticancer compounds, we investigated the plants of Antiaris toxicaria and Thevetia peruviana and isolated more than 70 cardiac glycosides. The chemical structures were characterized by 1H and 13C NMR spectroscopy and chemical derivatization, and we identified 35 new compounds. MTT assay revealed that several compounds selectively inhibited the proliferation of cancer cells but not normal cells in the nano-molar range of concentration. We showed that these compounds induced the expression of Nur77 protein and cell apoptosis in cancer cells. Further, these compounds seemed to lead to translocation of the Nur77 protein from the nucleus to the cytoplasm and subsequently to mitochondria. These results suggest that cardiac glycosides inhibit cancer cell growth by targeting the Nur77-dependent apoptotic pathway, illustrating great promise for discovering of new anticancer drugs.
Abstract

There are over two hundred different types of volatile organic compounds (VOCs) that can be found in the human breath in parts per billion concentration (ppb). Detecting VOCs concentrations is important because they represent an imbalance within the body, for example acetone gas for diabetes, trimethylamine for uremic patients or ammonia gas for renal disease. Breath detection has the potential to detect VOCs at very low ppb concentrations allowing for early stage detection and monitoring of many illnesses. The purpose of this sensor is to detection concentrations of acetone for dieting and fitness purposes.

Past literature has shown that for a concentration of 120 nmol/L, an individual will lose 0 to 57 grams a week. This device will measure concentrations of acetone, which will light up either a red or a green light, signaling whether or not it is okay to eat. Our team designed a prototype device that will allow breath to flow over the sensor and then give a measurement proportional to the concentration of acetone in breath. This measurement will be assessed by the system and output either a green or red light. Acetone signals the breakdown of fat in the body through the process of ketosis, which is critical to weight loss. The goal of this project is to develop a the non-invasive breath acetone measurement will relatively accurately assess the acetone concentration of the user.
Childhood Apraxia of Speech (CAS) is a severe, pediatric, speech sound disorder. Children with CAS are vulnerable for reading difficulties because of language difficulties associated with the disorder. Results of this study demonstrate the multi-factorial nature of CAS and the need for reading remediation to begin early with this population.

This poster project examines the reading outcomes for 56 children diagnosed with Childhood Apraxia of Speech during their preschool years who were then followed into adolescence or adulthood. Two-thirds of these 56 participants (36/56) scored at least 1 standard deviation below the mean on subtests of single word reading (decoding) during follow-up testing. The results of this descriptive study demonstrate the multi-factorial nature of Childhood Apraxia of Speech and the subsequent need for reading remediation to begin early with this population.
Among the 7+ billion persons in the world, praying to God is a very prevalent activity that enhances a person’s life in many ways. The frequency of prayer may be a good indicator of the value of religion. To estimate the frequency of daily prayers by all persons on the planet, I started out studying the adherents of the four major religions. The largest is Christianity (2.2 billion) the next is Muslim (1.6 billion) followed by Hindu (1 billion) and then Buddha (400 million). Other smaller religions have about 500 million adherents. Persons with no religion amounts to about 20% of the total population. Some of these people pray but not as they would if they believed in a particular religion.

The basic assumptions underlying this study are: 1. Persons under ten years of age were considered to not pray. 2. Surveys of frequency of prayer differed considerably and what seemed most reliable were used. 3. The frequency of prayer in persons who are not adherents to a particular religion required many assumptions and resulted in a very rough estimate.

This research is a work in progress and the details of deriving the estimates is too extensive for this abstract. My first estimates indicate that Christians say about 2.2 billion prayers a day. Muslims say about 4 billion prayers a day. It is widely known that many male Muslims pray five times a day. If they started praying at ten years of age and then live to 80 years, they will have said about 135,000 prayers in their lifetime. This is about the same for orthodox Jews. This statistic will be pursued for the other religions.

At this time I estimate that among the 7+ billion people, the number of prayers said every day is about eight billion, plus or minus one billion.

A friend who asked me about my research, and I mentioned this study, has reported back to me that my preliminary findings have changed and improved her view of God. Thus it is possible that this study (even though N=1) may effect a desirable behavior change that may be helpful to those who pray.
The purpose of this study is to pilot stimuli material of higher-level language skills to be used in a future intervention research project. A total of 170 stimuli (50 multiple-meaning words, 50 metaphors, 50 oxymorons and 20 paradoxes) will be piloted using an Internet-based survey. Participants will be children who are typically developing and between the ages of 12-14. A priori cut off of 75% accuracy for each item followed by Cronbach’s alpha at .75 (George & Mallory 2003) for stimuli that reach acceptable levels will be used to determine which stimuli items will be retained. The complete measure will be used for a future intervention study for children with specific language impairment.
Purpose and Research Questions: The purpose of this study was to explore self-management practices in adolescents and young adults ages 18-24 years with Sickle Cell Disease (SCD). Demographics and health care utilization were examined over a one-year period. The difference in health care appointments arrived for and subsequent healthcare utilization between two age groups, ages 18-24 years and greater than or equal to 25 years, was studied to answer the following research questions: (1) “Are there differences in SCD clinic appointment show rate and (a) emergency room (ER) visits and (b) hospital admissions based on age group?”

Hypothesis: Due to developmentally related self-management challenges, adolescents and young adults age 18-24 years will have a decreased clinic appointment show rate with an increased number of emergency room (ER) visits and hospital admissions based on age group.

Theoretical Framework: Bronfenbrenner’s Ecological Model and Meleis’s Transitions Theory guided this study. These two models provide a lens to view the transition from the pediatric to the adult healthcare environment based on developmental influences.

Method: A descriptive, retrospective chart review study design was used. The sample (N=105) included persons age 18-65 years diagnosed with SCD attending an outpatient clinic at a large tertiary medical center in the Midwest. Data were collected by retrospective chart review. A descriptive analysis was performed and a Multivariate Analysis of Variance is planned.

Results: The sample of SCD patients ages 18-53 years with 39% less than or equal to age 24 years, 98% African American, 52% female, and 76% not partnered/married. Descriptive data for the sample and differences between SCD clinic appointment show rate and (a) ER visits and (b) hospital admissions for these two age groups will be presented.

Conclusions: Nurses play a significant role in the care and support of adolescents and young adults during healthcare transitions. Instruction and evaluation of self-care management strategies should begin in early adolescence.
Proper patient identification during surgical procedures is currently a major concern. This problem is relevant to all surgical specialties, but is particularly important in Ophthalmology. While all surgical steps and protocols are meticulously pre-planned for all patients, during surgery some of this critical information can be misplaced or mixed up. In this scenario, it can result in the patient undergoing an incorrect surgery or “wrong-site” surgery. Wrong site surgeries are detrimental to the patient as well as the surgeon responsible and can lead to unnecessary injuries and legal conflicts. It has been reported that up to 79 percent of “wrong-site” eye surgeries have led to malpractice cases.

Therefore, it is our intention to develop a patient identification system that functions to maintain a patient’s privacy and enables physicians to easily access all of the patient’s surgical information in the operating room. The system created was a bracelet embedded with a NFC chip that links to a cloud server for the physician to easily access the patient’s record in the surgical suite.
In 2008, Case Western Reserve University President Barbara Snyder signed the American College and University Presidents’ Climate Commitment (ACUPCC), thus committing CWRU to become carbon neutral by 2050. My research evaluates the actions and progress toward climate neutrality made by CWRU and its peer institutions. Having obtained the majority of the data for the greenhouse gas inventory for fiscal year 2015, CWRU’s greenhouse gas emissions have fallen by over 14 percent since our last inventory in fiscal year 2012, the equivalent of 31,344 MTCO2e. Like in past years, the majority of CWRU’s emissions comes from purchased energy, though our total amount of purchased energy decreased by 11 percent since fiscal year 2012. There was a notable increase in Scope 1 Emissions (emissions that result from burning fuel in university-owned burners.) This increase was a result of an increase in fuel used in fleet vehicles and an increase in natural gas used in backup generators. In order to reach our goal of carbon net-neutrality by 2050, I propose that Case Western Reserve University institutes a voluntary air travel offset policy, where all emissions that result from university funded air travel are offset by purchasing credits from the Cleveland Carbon Fund. I also propose that with the perpetual increase in emissions associated with the university fleet, the university should reevaluate their fleet choices, decrease the number of vehicles, and invest in more fuel efficient replacements. Lastly, CWRU’s peer institution unanimously credit energy efficiency efforts with their reductions in greenhouse gas emissions. I propose that the university allocate more resources for upgrading existing buildings such that they fit a higher standard of efficiency. According to institutional data and information from peer universities, offsetting air travel, upgrading the university fleet, and increasing efficiency efforts could prevent up to 35,000 MTCO2e in emissions.
**Title**

*Thin Film Sensor Using Nanosphere-Patterned and Molecularly Imprinted Polymer Arrays for QCM Detection of Aspartame*

**Abstract**

A new detection protocol combining molecular imprinting and nanosphere lithography was developed producing a nanopatterned polyterthiophene film sensor capable of detecting aspartame. The artificial recognition sites capable of rebinding aspartame were made possible by imprinting aspartame into an electropolymerized molecularly imprinted polymer. The detection limit of the resulting sensor was ~31 ?M and has a good linear response when subjected to aspartame concentrations from 12.5 ?M up to 200 ?M. This sensor showed a high selectivity when matched up with other peptide-based analogs including alanine-phenylalanine (Ala-Phe), alanine-glutamine (Ala-Gln), glycylglycine (Gly-Gly), and arginylglycylaspartic acid (RGD). The highly ordered nanopatterned configuration was induced and monitored in situ by electrochemical quartz crystal microbalance and atomic force microscopy; analyte imprinting and removal were characterized using X-ray photoelectron spectroscopy. Based on molecular modeling (semi-empirical AM1 quantum calculations), the key to the effective aspartame imprinting and detection of this sensor is the formation of a stable pre-polymerization complex due to the strong hydrogen bonding interactions between the terthiophene monomer and aspartame.
**Objectives:** Venous ulcerations are contributed to venous insufficiency and edema. Compression therapy is used to control edema and decrease recurrence of ulcerations. Compliance with compression therapy is imperative to controlling the edema of the lower extremities. The purpose of this study was to evaluate compliance in patients with healed venous ulcerations that have been transitioned into compression stockings. We evaluated if patients had a greater compliance with a lower compression stocking. We hypothesized that subjects in the lower compression stocking therapy group would be more compliant with their application of stockings and therefore control their edema and reduce further episodes of ulceration.

**Methods:** This study used lower and higher end compression stockings to evaluate compliance in keeping venous ulcerations healed. Following IRB approval from our institution, patients were recruited from the University Hospitals Richmond Wound Care center that had healed venous ulcerations. They were randomized to either lower end compression 10-15 mm Hg or higher end compression 20-30 mm Hg. Two pairs of stockings were dispensed after the patient was fitted and measured. Patients had an initial lower extremity exam with photographs of the healed venous stasis ulcer. The follow-up was scheduled for one month, three months, six months, nine months and one year where they answered a questionnaire and underwent another lower extremity exam.

**Results:** A total of 17 patients with healed venous stasis ulcerations were recruited and randomized to either lower end compression (n=10) and higher end compression (n=7). 53% of patients dropped out at the first month visit and discontinued the use of their compression stockings. The reasons for dropping out included application difficulty, uncomfortable and too tight of stockings. 11% of the patients completed a one year course of wearing compression stockings.

**Conclusion:** Compression therapy is the gold standard in the management of venous insufficiency. Traditionally stocking compression is the most widely used modality with most prescriptions of 20-30 mm Hg. However, application difficulty and stockings that are uncomfortable may be the limiting factor in compliance of compression therapy despite our hypothesis that patients would be more compliant in the lower end versus the higher end compression stocking group. Further investigation in
PURPOSE

To evaluate the image quality of 70 keV monoenergetic images (monoE) abdominal CT images compared to 120-kVp polychromatic images generated from a spectral detector CT (SDCT) scanner.

METHOD AND MATERIALS

This prospective study included generation of a 120 kVp polychromatic dataset and a 70 keV monoE dataset after a single contrast enhanced CT acquisition on an SDCT scanner (Philips Healthcare) during portal venous phase. The attenuation values and noise were measured in the liver, spleen, pancreas, kidney, aorta, portal vein and muscle. The signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) were calculated. The image quality, including noise, soft tissue contrast, sharpness and overall image quality were graded on a 5 point Likert scale by two radiologists independently (1-worst image quality, 5-best image quality, ?3 defined as fair and >3 defined as good). Statistical analysis was performed using paired sample t test, Fleiss’s Kappa and Wilcoxon Signed-Rank.

Results

Thirty-eight patients (53.44±17.39 y/o; 23 M, 15 F) were recruited.

At 70 keV monoE level, there was no significant difference in HU values. The noise of target organs was lower in monoE images in compare to polychromatic images (p<0.002) (Table 1).

The SNR of target organs was higher in monoE images (p<0.02)

The CNR of the target organs was higher in monoE images (p<0.02).
Glutathione S-transferase P1 (GSTP1), an enzyme involved in detoxification process, is frequently inactivated in prostate cancer due to epigenetic modifications. We have previously demonstrated that green tea polyphenols (GTPs) and its major constituent (−)-epigallocatechin-3-gallate (EGCG) reactivate GSTP1 in human prostate cancer cells, however the mechanisms underlying the reactivation is currently not well understood. Treatment of prostate cancer LNCaP cells with GTP/EGCG increase p53 transcriptional activity through suppression of class I histone deacetylases. GTP/EGCG treatment activate p53 through acetylation at the Lys373 and Lys382 residues with consequent increase in GSTP1 protein expression in time-dependent manner. The interaction between GSTP1 and p53 was further studied by using LNCaP cells stably-transfected with short hairpin-RNA against p53 (LNCaPshp53) and control vector (LNCaPshV) for generation of p53 knockout cells. GTP/EGCG treatment induced p53 activation and acetylation at p53 Lys373 and Lys382 specifically in LNCaPshV cells in time-dependent manner, but not in LNCaPshp53. This increase in p53 acetylation led to activation of GSTP1 in LNCaPshV cells both at protein and message levels. GTP/EGCG-mediated increase in GSTP1 expression is caused by increase binding of p53 to its consensus binding site on the intron 4 of GSTP1 gene as analyzed by electrophoretic mobility shift binding assay. Furthermore, this association was validated by ChIP assay where GTP/EGCG treatment led to an increase in the amount of acetylated p53-Lys373 associated within the intron site of GSTP1, compared to untreated controls. Our findings demonstrate the ability of p53 to transcriptionally activate the human GSTP1 gene, which defines a novel mechanism of protection of the genome by green tea polyphenols.
The mission of ITS Research Computing is to facilitate cost-effective access to IT resources for the research community at CWRU, including high performance computing services, system administration services, database design and programming services, and pre-award IT consultation. Our organization is prepared to engage with faculty in technologies as they emerge at CWRU and incorporate them into the suite of centrally supported services.
Introduction: Food deserts have been shown to be highly correlated with chronic health conditions such as obesity and heart disease. A food desert is a Census tract where poverty is prominent (≥20%) and a substantial portion of the population (>33%) does not live within ½-mile of a supermarket. However, the ¼-mile boundary may reflect a more walkable distance in an area where populations have limited access to personal transportation. This study used spatial analysis to examine food options available at ¼- and ½-mile distances to assess the balance of healthy and unhealthy food resources available within a food desert.

Methods: We evaluated every food retail outlet in one neighborhood in Cleveland, OH (N=34) and scored them using an adapted version of the Nutrition Environment Measurement Survey in Stores (NEMS-S). This tool provides a score based on the availability, pricing, and quality of food options. Stores were categorized as low (≤10), medium (11-29), and high (≥30) and superimposed with a ¼- and ½-mile network buffer using GIS at the Census block level.

Results: An estimated 16.5% of the 8,230 residents do not have access to a household vehicle. This is reflected in the neighborhood NEMS-S score where the median score was 8, which is indicative of low availability, unequal pricing, and lower quality of healthy food options. At the ¼-mile distance, 50% of residents have access to only low-scoring stores or no store at all. At ½-mile, 32.4% of residents have access to a mixture of only low- and medium-scoring stores. At the ¼- and ½-mile level, 14.4% and 53.3% have access to the two supermarkets.

Discussion: Overall, this food desert is saturated in food retailers with limited healthy food options. There is a greater density of unhealthy food retailer options within walking distance. As the spatial parameter increases from ¼ to ½ mile, access to medium-scoring stores increases. This imbalance in access may influence diet-related behaviors and health outcomes.
Epigenetic modifications such as DNA hypermethylation mediated by DNA methyltransferases (DNMTs) and methylation of histone protein by histone methyltransferases (HMTs) are critically involved in alteration of gene expression associated with various physiological processes, as well as in the pathogenesis of various human diseases including cancer. Dietary plant flavones have shown health-beneficial effects that can affect epigenetic modifications accumulated over time. Through in silico protein-ligand docking studies and molecular studies with plant flavones viz. chrysin, apigenin and luteolin we assessed their effect on DNA and histone methylation. These ligands were individually docked into the pocket of DNMT and EZH2 using Glide in XP (extra precision) mode (Schrodinger, LLC). Binding of ligands with proteins were evaluated using Glide Score, which is an empirically derived scoring function. Virtual screening approach using the model of the catalytic site of DNMT and EZH2 demonstrated that plant flavones tethered at both ends inside the catalytic pocket of DNMT and EZH2 by means of hydrogen bonding. Flavones exhibited a high docking rank (Glide score) in the order of chrysin<apigenin<luteolin which was higher compared with the pharmacological inhibitor, 5-Aza-2?-deoxycytidine. Notably, all three flavones inhibited EZH2, having a high docking rank compared to the known pharmacological inhibitor, 3-Deazaneplanocin A (DZNep). Epigenetic studies performed with plant flavones demonstrated reversal of hypermethylation of cytosine bases in the DNA and prevented methylation of cytosine in the GC-rich promoter sequence incubated with M.SssI enzyme. Furthermore, decrease protein expression of EZH2 and trimethylation of H3K27 was noted in prostate cancer cells treated with these plant flavones. These results suggest that plant flavone can alter DNMT and HMT activities and methylation of DNA and histone proteins that regulate epigenetic modifications providing significant health-effects.
The Surface Ectoenzyme Vanin-2 (VNN2) Identifies CD14+ HLA-DRneg/Low Human Monocytic Myeloid-Derived Suppressor Cells

This study provides evidence for the identification of a novel biomarker -VNN2- implicated in the fight against cancer. The Vannin-2 (VNN2) protein is a surface enzyme that appears to be enriched in a type of cell called Monocytic Myeloid-Derived Suppressor Cell (Mo-MDSC).

Abstract

Studies of human Myeloid-Derived Suppressor cells (MDSC) have been hampered by the lack of specific cell-surface markers. Specifically, human Monocytic MDSC (Mo-MDSC) are currently characterized as CD14+ HLA-DRneg/low. Vanin-2 (VNN2) is an ectoenzyme described in monocytic subsets displaying reduced antigen presentation and high reactive oxygen production, hallmarks of MDSC. In order to determine whether VNN2 was present in cells we currently classify as Mo-MDSC, we used flow cytometry to purify Mo-MDSC cells and compared VNN2 mRNA expression versus CD14+ HLA-DRhigh monocytes by qPCR. Interestingly, VNN2 mRNA was expressed 30-fold higher in Mo-MDSC compared to CD14+ HLA-DRhigh monocytes; concordantly, VNN2 protein expression on Mo-MDSC was 68%, compared to only 9% in CD14+ HLA-DRhigh cells (n=4 p<0.01). Analytic examination of the top 10% of VNN2-expressing CD14+ (CD14+ VNN2high) cells by flow cytometry revealed expression of CD33 and CD11b, whereas CD3, CD15, CD19 and CD56 were all negative and HLA-DR was negative or low, which is consistent with the phenotype of human Mo-MDSCs. Sorted CD14+ VNN2high expressing monocytes inhibited proliferation of CD8 T cells in a manner comparable to the suppressive capacity of traditional HLA-DRneg/low Mo-MDSC at ~51% and 48% of control proliferation, respectively. MDSC previously shown to be increased in renal cell carcinoma (RCC) patients, expressed elevated VNN2 on monocytes of in RCC patients. These results suggest that intense surface expression of VNN2 on CD14+ cells selectively marks a subpopulation of monocytes consistent with Mo-MDSC phenotype, and may be an alternative approach to positively identify, quantify and isolate functional live human Mo-MDSC.
Objective: To determine the time course of changes in circulating SNO levels and transplantable organ function following brain death (BD).

Background: Transplantable organ function following brain death is negatively impacted by reduced perfusion and increased inflammation, processes regulated by protein S-nitrosylation; this dysregulation continues during storage. We will depict the effects of BD on protein nitrosylation, particularly on S-nitrosohemoglobin and micro-vascular blood flow in human donors.

Methods: Once BD is confirmed and consent for organ donation is obtained, a standard donor support regimen is enacted. Serial sub-lingual images of the micro-vasculature will be obtained at regular intervals during the support phase. In addition, we will use NIRS probes placed on the torso and legs for continual monitoring of tissue oxygenation and blood flow. Therapy and monitoring will continue through organ procurement.

Results: Circulating nitric oxide bioactivity (S-nitrosohemoglobin) was markedly diminished after confirmation of brain death in human donors—a decline that was associated with decline in tissue blood flow and oxygenation, increase in markers of cellular injury, and deterioration of organ function.

Conclusions: In organ human donors, the parameters monitored in this study are predictive of post-graft function. As such, maintenance of endocrine nitric oxide bioactivity after brain death may provide a notable means to improve the quality of organs available for donation.

Key words: S-nitrosothiols, nitric oxide, brain death, blood flow, donor support, tissue oxygenation.
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. Addition of an S-nitrosylation agent during renal storage could restore kidney micro-circulation and thus improve organ function.

We found a novel S-nitrosylating agent could improve in ex vivo human renal function during storage. It can restore kidney microcirculation. The parameters (flow rate / resistance) that were tracked are predictive of post-graft function suggesting a novel method to improve the quality and quantity of kidneys available for transplant.
Extracellular matrix (ECM) remodeling is an early event during tumor invasion and metastasis involving matrix metalloproteinases (MMPs), a family of 25 individual metzincin endopeptidases. MMPs are naturally inhibited by tissue inhibitor of matrix metalloprotenaise (TIMPs) that are classified as TIMP-1, 2, 3, and 4. Reports suggest that TIMPs possess tumor suppressive function as downregulation of TIMPs facilitate cancer cell migration and invasiveness. In prostate cancer, epigenetic silencing has been suggested for the loss of TIMP-3, which involves increase activity of the enhancer of zeste homolog 2 (EZH2) and class I histone deacetylases (HDACs), independent of promoter DNA hypermethylation. In recent years, anticancer activity of green tea has been highlighted due to alterations in epigenetic mechanism(s). We determined whether treatment with green tea polyphenols (GTP) or its major constituent (-)-epigallocatechin-3-gallate (EGCG) has ability to restore TIMP-3 levels and play a key role in suppressing invasiveness in prostate cancer. Treatment of human prostate cancer LNCaP and DUPRO cells with 10µg/mL GTP and 20µM EGCG for 72 h significantly induced TIMP3 mRNA and protein levels. Silencing of enhancer of zeste homolog 2 (EZH2) and class I histone deacetylases (HDACs) significantly increased the expression of TIMP-3, independent of DNA hypermethylation. GTP/EGCG treatment significantly reduced EZH2 and class I HDAC protein levels; H3K27 trimethylation activity; and transcriptional activation of TIMP-3 was found to be associated with decreased EZH2 localization and H3K27 trimethylation enrichment at the TIMP-3 promoter with a concomitant increase in histone H3K9/18 acetylation. EGCG/GTP treatment also caused a global reduction in histone methylation thereby increasing histone acetylation to revive and activate TIMP3 levels. EGCG/GTP exposure significantly reduced MMP2/9 gelatinolytic activity and abrogated invasive and migration capabilities in cancer cells. Our findings suggests that TIMP-3 induction could be a key epigenetic event modulated by GTPs in restoring MMP: TIMP balance to delay prostate cancer progression.
We have previously established that the ERK MAP kinase pathway is central to the pathogenesis associated with 16p11.2 deletion mouse model. This deletion contains 27 genes including the ERK1 gene (MAPK3), MVP and KCTD13, with the latter two converging onto the MAPK pathway. ERK1 and its homolog, ERK2 are central elements of the MAP kinase pathway, one of the most prominent intracellular signaling pathways governing neural development and synaptic plasticity. Importantly, the ERK MAPK pathway is genetically linked to autism spectrum disorders (ASDs) and other syndromes typified by intellectual disability. We provide direct evidence connecting the ERK MAP kinases to the developmental abnormalities in neurogenesis and cortical cytoarchitecture associated with the 16p11.2 chromosomal deletion and its behavioral manifestations. Specifically, we reported that a murine model of human 16p11.2 deletion exhibits a paradoxical increase in ERK activation in the developing cortex and hippocampus that persists into adulthood. This leads to altered progenitor proliferation dynamics and premature cell cycle exit, both a consequence of altered levels of downstream ERK effectors, cyclin D1 and p27Kip1. Furthermore, the altered proliferation dynamics result in premature depletion of progenitor pools, altering the number of neurons ultimately populating cortical lamina. These changes in cortical cytoarchitecture contribute to the behavioral abnormalities seen in these mice. Most importantly, we demonstrate that treatment with a novel ERK specific inhibitor during development rescues aberrant cortical cytoarchitecture by restoring normal levels of potent cell cycle regulators during cortical neurogenesis. Furthermore, these treatments reverse the behavioral deficits observed in the 16p11.2del mouse model, including hyperactivity, memory as well as olfaction, and maternal behavior. Remarkably, we also report a partial rescue of these deficits upon treatment of adult 16p11.2del mice. Therefore, providing a strong rationale for therapeutic approaches to this disorder.
Late term complications of hematopoietic cell transplantation (HCT) are numerous and include incomplete engraftment. One possible mechanism of incomplete engraftment after HCT is cytokine-mediated suppression or dysfunction of the bone marrow microenvironment. Mesenchymal stromal cells (MSC) elaborate cytokines that nurture or stimulate the marrow microenvironment by several mechanisms. Administration of exogenous MSCs, in the setting of incomplete engraftment, may modulate the bone marrow milieu and improve blood count recovery. In the current study, our hypothesis is that intramuscular administration of human placental derived mesenchymal-like adherent stromal cells (PLX-R18) will improve human myeloid engraftment in a mouse model of transplant.

Umbilical cords were obtained from University Hospitals Case Medical Center under an IRB approved protocol. CD34+ cells were labeled and magnetically separated using the Miltenyi MACS system. PLX-R18 cells were provided by Pluristem Therapeutics, Inc., and have been demonstrated to have biological activity when given for radiation syndrome. NOD scid gamma (NSG) mice were obtained from Jackson Laboratories. Following non-lethal irradiation (300rads), 2 groups of NSG mice were studied: 1) intravenous (IV) 5x10^5 UCB CD34+ cells, 2) IV 5x10^5 UBC CD34+ cells and 1x10^6 IM PLX-R18 on D2 and D7. At 2, 4, 6 and 8 weeks, peripheral blood samples were analyzed for human hematopoietic cells using antibodies against human CD45, CD3, CD13, CD14, CD19 and CD41. At 8 weeks, the bone marrow was analyzed for engraftment using the same antibodies.

Within the peripheral blood, analysis of human CD45 and CD19 revealed the highest level of chimerism in the IV UCB / IM PLX-R18 cohort at week 4 and week 6. Within the bone marrow, the IV UCB / IM PLX-R18 cohort demonstrated increased CD45 lineage cells in the bone marrow at 8 weeks as compared with the IV UCB cohort control. This study suggests that intra-muscular injection of PLX-R18 may improve engraftment of human UCB in NSG mice when given post-transplant. Cytokine analyses of the serum are ongoing. This strategy is intriguing in that it may improve engraftment in patients who have incomplete engraftment after hematopoietic transplantation. A translational study will be undertaken in a phase I clinical trial at our institution.
Abstract

Background: In persons with spinal cord injury (SCI), lower thoracic spinal cord stimulation (SCS, 50 Hz) results in large positive airway pressure generation, and is a useful method to restore an effective cough mechanism. Unfortunately, activation of the expiratory muscles via SCS requires high stimulus amplitudes, which may also cause unwanted side effects including stimulation of pain fibers. This method, therefore, cannot be applied in patient populations with intact sensation. The purpose of the present study was to evaluate the efficacy of high frequency (>200 Hz) SCS (HF-SCS) using much lower stimulus amplitudes, which has the potential to expand SCS application to groups of persons with intact sensation.

Methods: In 3 anesthetized dogs, we evaluated the effects of varying stimulus amplitudes and frequencies on positive airway pressure generation. Stimulation was applied via a disc electrode positioned at the T9 spinal cord level. Given our previous success with the monopolar 4mm disc electrode positioned epidurally at the T9 level via a laminotomy incision, the responses to conventional stimulus frequencies were used as our gold standard to which all comparisons were made.

Results: At any level of stimulus current, mean expiratory airway pressure generation was largest at 500Hz, compared to all other stimulus frequencies. For example, with stimulation at 1mA and frequencies of 50, 200, 300, 500 and 600Hz, expiratory airway pressures were 12±6, 26±2, 39±2, 60±5 and 51±6cmH2O, respectively. In comparison, the mean airway pressure generation of these animals with conventional SCS parameters of 50Hz and 15mA was 66±8 cmH2O.

Summary: Results suggest that epidural HF-SCS produces a comparable level of expiratory muscle activation and positive airway generation to that achieved with conventional SCS parameters but with much lower stimulus amplitudes. Lower thoracic HF-SCS may be a useful method to restore an effective cough in non-SCI patient populations.
Glioblastoma ranks as one of the most lethal human cancers, for which there are no effective therapies. To discover novel therapeutic targets, here we performed parallel in vivo and in vitro RNA interference screens of epigenetic regulators and show that transcription elongation factors are essential for human glioblastoma cell survival in vivo, but not in vitro. This in vivo context-specific dependency is driven by global changes in the cancer transcriptome and epigenome, which is reflective of the more complex in vivo tumour microenvironment. We find that the transcription pause release factor JMJD6 is a top in vivo-specific hit and binds to enhancers of stress and stimulus response pathway genes to increase their expression in vivo. We also show that knockdown of JMJD6 in patient-derived glioblastoma cells enhances survival of mice bearing orthotopic tumours. Moreover, elevated levels of JMJD6 alone, as well as transcription elongation factors collectively, informs tumour grade and predicts poor patient prognosis. Our work provides a rationale for targeting the transcription elongation machinery as a therapeutic strategy in glioblastoma. More broadly, it demonstrates the power of in vivo phenotypic screening to identify therapeutically relevant targets in cancer.
Inflammasomes are multi-protein complexes that sense danger associated molecular patterns (DAMPs) which could be either pathogenic microorganisms (like bacteria or fungi) or sterile stressors (like silica, asbestos, ATP and pore forming toxins). Activation of inflammasome leads to production of highly proinflammatory cytokines like IL-1β and IL-18. Our previous studies have revealed presence of functional NLRP3 inflammasome in murine and human neutrophils which was activated by Streptococcus pneumoniae pore forming protein – pneumolysin (Karmakar, M et al, J of Immunol, 2015).

Although extracellular ATP – which serves as a DAMP, is abundant at sites of inflammation, its role in activating inflammasome signaling in neutrophils is not well characterized. In the current study, we demonstrate that human and murine neutrophils express functional cell surface purinergic P2X7 receptor, which leads to ATP-induced loss of intracellular K+, NLRP3 inflammasome activation and IL-1β secretion. ATP-induced P2X7 activation also caused a sustained increase in intracellular [Ca2+], which is indicative of P2X7 channel opening. Although there are multiple polymorphic variants of P2X7 receptor in human population, we found that neutrophils from multiple donors express this receptor, but with differential efficacies in ATP-induced increase in cytosolic [Ca2+]. Neutrophils were also the predominant P2X7 expressing cells during Streptococcus pneumoniae corneal infection in mice, and P2X7 expression on neutrophils was required for optimal bacterial clearance. Given the ubiquitous presence of neutrophils and extracellular ATP in multiple inflammatory conditions, ATP-induced P2X7 activation and IL-1β secretion by neutrophils likely has a significant, wide ranging clinical impact.
Analysis on Flume Test of Local Scour around Pile Groups Embedded in Sandy-Cohesive Soil

Bridge scour is one of the main causes of bridge failures. In the past decades, more than 1000 bridges collapsed in the United States, and the annual cost for scour-related bridge failures is estimated at $30 million. Research on the mechanism of bridge scour should be done to avoid loss of life and property.

Sandy-Cohesive soil is widely distributed in most part of China, while the study of this sort of soil is obviously deficient at present stage. In this study, flume tests on piles in sandy-cohesive soil condition were carried out. In the group of single pile, the clay placed on the sandy soils was 0.5 cm and 1.0 cm thick respectively. The results were compared with those in sandy soils. In tandem and side-by-side group, the clay placed on the sandy soils is 1.0 cm thick, and the conclusion in sandy-cohesive soils was claimed. The results show that the equilibrium scour depth is less than those embedded in sand due to the constraint induced by the clay. In the process of scour, there is a threshold which means the junction between sand and clay. The scour rate changes dramatically around the threshold, which brings danger to the bridge.
Climbing trees, building forts, digging holes, setting fires, puddle jumping and playing house makes better 3 grade readers especially 3 graders attending public schools in urban communities. This proposed innovative research seeks to test the hypothesis that believes given permission to design and transform urban vacant lots in their community into adventure playgrounds, these kids will become better readers.

Third grade is that pivotal moment in the life of a primary school student where becoming fluent in not just reading but reading comprehension is of utmost importance. It is that moment when learning to read becomes reading to learn (Hernandez 2011) and a predictor of future academic success. Key ingredients for this transition is learning to master new skills through challenge, risk taking and by stretching learning limits. For 3rd graders who attend urban public schools this transition can be challenging and for some this task can be insurmountable according to the Hernandez 2011 research study. One method that may support 3rd graders in mastering reading and reading comprehension is risky (adventure) play. Risky (adventure) play can be defined as a thrilling and exciting activity and play that provides opportunities for challenge, testing limits, exploring boundaries (Sandseter (2007; Little & Wyver, 2008). Research also shows through risky (adventure) play kids develop their coping skills (Sandseter and Kennair 2011) and as Apter (2007) explains risky (adventure) play is like preparation for life’s risks as a kid before they become adults. Limited research is being conducted on children in the US on the impacts of this type of play due to the nature of the risk involved in this type of play.

This proposed study is designed to explore this question, can the reading abilities of 3rd grade children attending urban public schools be positively impacted when given the opportunity to co-create adventure playgrounds on vacant lots in their community?
Obesity is the greatest public health challenge of the 21st century, affecting one-third of the US population inducing a medical cost of $147 billion annually. The homeostatic imbalance between regulatory and inflammatory T lymphocytes has been studied extensively as a major player in causation of obesity. A decline in the number of circulating and locally residing T regulatory (Treg) cells and increase in CD 8+ cytotoxic T cells in adipose tissues is a hallmark of adiposity, inflammation, and insulin resistance. Recently, signal transducer and activator of transcription 3 (Stat3) has been implicated as a critical mediator in this process; however, the factors that initiate this inflammatory cascade remain largely unclear. Cyclin-dependent kinase 5 (Cdk5), is known otherwise for its role in regulating the development and function of cells in the neuronal lineage, was recently reported by our lab to have a significant role in differentiation and regulation of T cells via modification of Stat3.

Here we show for the first time that the mice with T cell lineage-restricted deletion of the Cdk5 gene are resistant to age- and high-fat diet induced obesity. This was confirmed by their body mass index, histopathological analysis of adipose tissue as well as magnetic resonance imaging to study adipose tissue distribution. They were also found to have lower blood sugars and insulin levels after being fed a high fat diet for 16 weeks, indicating a lower tendency for Type 2 Diabetes.

Also noted in these mice was an increase in circulating CD4+ CD25+ Foxp3+ Treg cells along with a marked decrease in Ser-727 phosphorylation of Stat3, indicating that Cdk5 contributes to adipose tissue inflammation in obesity through suppression of Treg differentiation. These results further solidify the role of Cdk5 as an essential regulator of T cell function and implicate Cdk5 as a potential therapeutic target for prevention and treatment of diet induced obesity and its complications.
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 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.
Breast cancer is the most prevalent cancer in women and the second leading cause of cancer-related mortality in women. Therefore it requires a better understanding as well as more effective therapies. Spontaneous metastasis is a multi-step sequential process of tumor cells spreading from the primary tumor site to the distant organs. Tumor cells lose cell adhesion to each other, invade into the surrounding tissue, enter the bloodstream or lymphatics, and move to and colonize distant organs. Metastatic cancer cells are often resistant to conventional therapies and accounts for the majority of deaths from breast cancer. Circulating tumor cells (CTCs) are cells that detach from the primary tumor and circulate in the blood, seeding metastasis. We have found that clustered CTCs survive better in the circulation and more efficiently mediate lung metastasis than single CTCs. These cells may undergo reversible epithelial-mesenchymal transition (EMT) during metastasis. In this process, the tumor cells must interact with stroma and/or their microenvironment in order to metastasize efficiently. Platelets have been shown to assist CTC-mediated metastasis by attaching to and covering them, acting like a shield against the body’s immune system. They may also provide some nutrients or growth factors in order to help them survive. To dissect the interactions between CTCs and platelets in the blood vessels during circulation, we created breast tumor patient-derived xenograft (PDX) models by implanting patient tumor (pieces or cells) into the mouse mammary fat pads. In this model, we demonstrated that CD44+ breast cancer stem cells (CSCs) are able to mediate spontaneous lung metastasis. In order to do so, we stained for platelet marker CD41 and CSC marker CD44 with immunohistochemistry (IHC) in paraffin-embedded breast cancer tissue and micrometastasis-containing lung tissue from mice. Co-localization was observed between the platelets and CSCs in these tissue sections. Further research is needed to determine if platelets have a role in CTC clustering. For example, we could examine the importance of platelets in CSC/CTC-mediated clustering in vitro and lung metastasis in vivo. If we can provide direct evidence for the role of platelets in CSC/CTC metastasis, we can design specific inhibitors to block this interaction and reduce metastasis.
Symptom Patterns in Persons with COPD

Chronic obstructive pulmonary disease (COPD) is a blanket diagnosis for any disease phenomenon that obstructs the pulmonary tree usually caused by some form of chronic inflammation (Seamark, et al., 2007). Diagnoses such as asthma, emphysema, pulmonary fibrosis, chronic bronchitis, pneumonia, asbestosis and mesothelioma are all included under the umbrella of COPD. The World Health Organization (2008) predicts that this diagnosis will become the third leading cause of death in the United States by the year 2030. Currently there are an estimated twenty four million Americans diagnosed with one or more of the aforementioned diagnosises (Center for Disease Control and Prevention, 2015). Hospitalizations including COPD as a primary or secondary diagnosis were reported as 3.8 million length of stay days in 2008 (Agency for Healthcare Research and Quality, 2011), with an average individual cost per day of $7500, equaling $65 million per year nationwide. Symptoms associated with COPD includes dyspnea, fatigue, cough, pain, unintended weight loss, lung infections, depression, anxiety, insomnia and social isolation with a decrease in self-reported quality-of-life. While symptoms can be diagnosed and treated individually, symptoms typically occur in patterns of two or more simultaneously, which make assessment of the disease process difficult (Aktas, 2010 and Breland, et al., 2015). Symptom clusters have also been shown in cancer and cardiovascular disease to correlate with an increase in mortality (Parks & Larson, 2014). While clusters of symptoms have been suggested in various disease processes, there is little current information specific to patterns in COPD. Also there is a lack of research which documents the relationship of symptom patterns to overall quality of life. This poster introduces research questions for investigation as a first study to develop a model to improve quality of life and palliative care in patients with COPD.
Orthogonal Savonius-Type Wind Turbines: Design and Experimentation

Finnish Engineer Sigurd Savonius introduced a vertical drag rotor in 1922 and named it Savonius turbine. It consists of two semi cylindrical blades in an “S” shape from the top view. Savonius turbines provide some advantages such as a simple and low-cost structure, self-starting capabilities and the ability to use wind speed from any direction. Savonius machines are widely used in many ways, including pumping and sailing. However, it has a poor power coefficient, typically in the range of 10% to 15%. In order to find new solutions to improve the aerodynamic efficiency this project designs, manufactures and tests experimentally six Savonius prototypes.

The prototypes combine different geometric characteristics. The experimental validation is conducted at the fully instrumented wind tunnel at the CWRU Control & Energy Systems Center. The results give guidelines to improve the efficiency and reduce the cost of the Savonius type wind turbines.
Neuroprostheses utilizing functional neuromuscular stimulation provide constant stimulation to the nerves/muscles of the lower extremities to enable individuals with spinal cord injury to stand erect from seated position in their wheelchair. However, these devices only enable users to maintain one position. To vary their postures to perform other functional activities, users must exert upper extremity (UE) effort on a support device, such as a walker or countertop. We conducted preliminary experiments to determine the effects of altering stimulation on standing postures for two recipients of an implanted neuroprosthesis. Our hypothesis was that as posture changes, appropriate changes in stimulation to the ankle and hip muscles will reduce UE effort exerted on a support device. First, the subjects stood with an instrumented walker and were instructed to lean as far as possible from erect stance to the following directions: forward, right, left, diagonal right, diagonal left. When they reached the end-point, their center of pressure (CoP) and UE force were measured. Using these data and subject-specific 3D computational musculoskeletal models, the optimal set of muscle activations required to maintain the postures was computed by inverse dynamics and were scaled to the corresponding threshold and saturation pulse width levels for each stimulus channel of the neuroprosthesis. Next, the subjects adjusted their standing postures to move their CoPs from erect to the locations attained in the first set of experiments. Real-time visual feedback of CoP location and target CoP position enabled the subjects to attain the original postures elicited in the first experiment. After stabilizing at the new end-points, baseline stimulus levels were adjusted to coincide with the optimal values for each new CoP location, while the UE forces were measured. For Subject 1, optimal stimulation resulted in a mean reduction of about 30% between the left and right UEs for the forward direction and about 5% and 10% reductions in the diagonal directions (diagonal left and diagonal right, respectively). For Subject 2, there was a mean reduction of about 4% in the forward, 11% in the right, 7% in the left and 13% in the diagonal left directions. These findings suggest that optimal stimulus levels have the potential to reduce UE force.
The APT Center focuses on the practical medical needs of veterans 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 transfer to outside manufacturers.

Key Words
- Wireless Health Monitoring and Maintenance
- Louis Stokes Cleveland VA Medical Ctr.
- Orthotics
- Neural Interfaces

Abstract
The APT Center focuses on the practical medical needs of veterans 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 transfer to outside manufacturers. Our R&D and translational programs focus on prosthetics and orthotics, wireless health monitoring and maintenance, neural interfaces and emerging enabling technologies. To date, Center projects have concentrated primarily on developing new materials and microsystems for interfacing with the nervous system, repairing orthopaedic trauma and accelerating wound healing, replacing or restoring natural limb, sensory and organ system function, and both monitoring and promoting neurological, genito-urinary and vascular health.
Adjustment Problems of Female Spouses of International Students: Theoretical Frameworks

Female spouses of international students experience a unique set of challenges. For example, they experience a lack of purposeful activities, a loss of professional identity, language barriers, financial stress, and they miss family and friends.

The purpose of this study is to analyze these adjustment problems of female spouses of international students with three theoretical frameworks – feminist perspectives, role theory, and acculturation theory. This study explores how adjustment problems can be explained by these theoretical frameworks. In addition, this study suggests some practical implications as follows.

Providing assistance to spouses requires taking into account their cultural diversity and being aware of the individual stages they go through in their adjustment process. There is an urgent need for academic institutions, immigration policymakers, and sponsors alike to investigate educational and professional opportunities for spouses of international students. By doing so, institutions will help the spouses not only in the short-term, but will also give them access to invest in their education and career goals, which, in turn, would allow them to become contributors to society at large, whether they return home or not.

Coordinating support groups for spouses as safe places to express and share their personal experiences is highly recommended. Understanding that they are not alone in this difficult adjustment process and hearing how others are dealing with similar situations will allow the spouses to put their own circumstances in a better perspective. The groups would also assist each spouse in revising her original project for the sojourn, and evaluating the best ways to accomplish it. The participation of spouses who are going through different phases of the acculturation process will enrich the group, and increase its effectiveness, as old-timers serve as role models by sharing will new-comers how they managed to overcome the initial difficulties.
When considering the self-management of diseases, it is common that interventions become standardized to treat a wide population. Within this standardization, self-management often loses its compliance. By studying the prevalence of tailored interventions among adults with mobility-impairing neurological and musculoskeletal conditions, opportunities for tailored intervention approaches may be unveiled.

Abstract

In the pursuit of evidence-based guidelines to support patients in self-managing symptoms, we risk standardizing processes of support, which jeopardizes the patient-centeredness of self-management care. To avoid this risk, we must learn how best to tailor self-management education. Thus, we conducted a systematic review to identify randomized controlled trials (RCTs) of tailoring strategies used in self-management interventions among adults with mobility-impairing neurological and musculoskeletal conditions. The following inclusion criteria were used: (i) RCTs evaluating self-management/behavior change interventions, (ii) intervention content that is modified based on assessment of the characteristics of each participant, (iii) community-dwelling adults with chronic neurological or musculoskeletal conditions that characteristically result in lower-extremity mobility impairments, and (iv) included measures of healthy behaviors as a study outcome (e.g., medication adherence, physical activity, nutrition). Exclusion criteria were: (i) research studies primarily evaluating the effects of an exercise program, medications, or vocational rehabilitation programs, (ii) studies including children or adolescents, (iii) studies on older adults without the above defined conditions, and (iv) studies on motivational interviewing. The initial search using relevant MeSH terms and subject terms yielded 571 articles; 10 of these articles met the criteria. Evidence indicates that tailored self-management interventions may be effective in promoting healthy behaviors and improving quality of life. Several studies focused on tailoring content to preferences, health status, and demographics. Thus, understanding how best to tailor self-management interventions is still in its formative stages. We recommend using a patient-centered approach that includes understanding the needs, preferences, and cultural background of the patient when developing a tailored self-management care plan.
Purpose: The American Academy of Pediatrics recommends exclusive breastfeeding for about 6 months, with continuation of breastfeeding for 1 year or longer as mutually desired by mother and infant. The Baby-Friendly® designation recognizes hospitals for implementing the Ten Steps to Successful Breastfeeding and providing breastfeeding support. As a mother experiences breastfeeding and caring for her infant, maternal role competence may develop. The purpose of the study was to determine mothers’ perception of breastfeeding support and their level of maternal role competence at the time of discharge from a Baby-Friendly® hospital.

Methods: A convenience sample of 30 women was recruited from a Baby-Friendly® designated hospital in Northeast Ohio. The research questions were: What is a mother’s perception of breastfeeding support at discharge from a Baby-Friendly® hospital?; What is a mother’s perception of her level of maternal role competence at discharge from a Baby-Friendly® hospital? The independent variable identified for the study was Baby-Friendly® Hospital which was defined as a hospital that has met the criteria to be designated as a Baby-Friendly® hospital by Baby-Friendly® USA. There were two dependent variables identified for the study. The first was breastfeeding support and was defined as the care provided to a first time mother incorporating the Ten Steps to Successful Breastfeeding by healthcare professionals during the postpartum hospital admission. The second dependent variable was maternal role competence which was defined as a first time mother’s self-reported confidence in caring and nurturing her infant. The mothers completed three self-reported questionnaires: a Demographic Questionnaire, The Breastfeeding Support Questionnaire and The Perceived Maternal Parenting Self-Efficacy scale on day of discharge.

Findings: The sample included 25 primipara and 5 multipara adult mothers. Mothers reported the presence of breastfeeding support with a mean total score of 10.70 (SD =1.42) out of a possible score of 13. Mothers reported that they perceived a high level of maternal role competence as evident by mean total score of 69.80 (SD= 6.86) out of 80. Baby-Friendly® hospital designation, as implemented in the study site, appears to have created an environment that supported breastfeeding and self-reported maternal role competence.
A Hybrid Neuromechanical System for Walking after Paraplegia

Restoring stepping for individuals with spinal cord injury using functional neuromuscular stimulation improves mobility, while providing physical and physiological benefits from using their own muscles. A “muscle-first” self-contained hybrid lower limb exoskeletal system provides opportunities for walking outside the laboratory environment and in real world conditions.

Stepping can be restored for individuals with paraplegia due to spinal cord injury using a hybrid neuroprosthesis (HNP), which combines functional neuromuscular stimulation to contract lower limb muscles for driving limb movements and a passive controllable lower extremity exoskeleton to provide stability and support. This preliminary study evaluated the implementation of a “muscle-first” untethered HNP system in its ability to restore stepping for an individual with paraplegia. The self-contained HNP system was operated by an onboard controller that sampled sensor signals and determined the appropriate commands for the lower limb exoskeleton and stimulation, and transmitted the data wirelessly to a portable tablet via Bluetooth for offline analysis. The subject selected standing up, stepping, or sitting down states using a wireless finger switch that communicated with the onboard controller. Within the stepping state, a gait event detection controller used sensors on the exoskeleton to transition between the different phases of gait such as double stance, swing, and weight acceptance. The different states of the finite state machine governed the locking and unlocking of the exoskeletal hip and knee joints as well as the stimulation pattern used to contract hip and knee flexor or extensor muscles. The subject completed multiple trials of stepping with the self-contained HNP. This study was one of our first successful implementations of a “muscle-first” untethered hybrid neuromechanical system restoring stepping for an individual with paraplegia. Future work involves optimizing the control system and initial clinical evaluation outside the laboratory under real world conditions.
### Abstract

Animals rely upon integrated sensory information for spatial navigation. A question of wide importance in navigation is how sensory cues get transformed into a neural code that represents the animal's position within its immediate environment. Here, we investigated the possibility of head direction coding in the central complex of the cockroach, Blaberus discoidalis. We used extracellular recordings in restrained animals that were rotated on a platform relative to a fixed landmark. The passive rotations allowed us to look at head direction coding in the absence of self-motion cues. Our results indicate that individual units in the central complex are capable of encoding head direction relative to a landmark's position in a variety of manners. Head direction tuning could be established even in the absence of visual cues, suggesting that cockroach head direction cell activity can be maintained solely based on the internal motion cues derived from the passive rotations. Additionally, some units in the central complex encoded rotational direction history suggesting that they contribute to spatial memory. Together, these results describe head direction cells in the insect central complex, which highly resemble similarly functioning cells in the mammalian brain that encode head direction. We predict the observed head direction cells are essential components of the brain circuitry mediating insect navigation.
First responders to trauma incidents must be able to quickly stabilize a patient’s temperature. Currently-prescribed therapeutic, hypothermia treatments rely on utilizing a chilled fluid transferred via intravenous injection to accomplish the task. Our focus is to design and implement a new method for rapidly cooling IV fluid bags for an ambulance. We found this was best done through preemptive cooling in a device and using the fluid bag in an insulated storage. The device uses ice packs, naturally found in an ambulance, that will cool the fluid from room temperature to below 4C. The device will consist of a 3D printed outer cylinder and a rotating thermally conductive inner cylinder. The device will run for one minute using a push button system and will cool the fluid to the appropriate near freezing temperature.
Abstract

Developing novel multi-component interfaces and hierarchical assemblies with high spatial control is an important strategy in nanoscale manufacturing of various sensors, functional coatings, electronic and plasmonic devices. In this work, a dual patterned surface composed of a conducting polycarbazole and gold was fabricated by combining colloidal lithography and electrochemical deposition. The binary patterning protocol begins with the highly ordered formation of a hexagonally close-packed array of sacrificial colloidal microspheres on a conductive substrate. Interstitial spaces between the colloidal template expose electrochemically accessible areas of the electrode which are still capable of nucleating the electrochemical polymerization of conducting polymer such as a polycarbazole film. After electropolymerization, the sacrificial colloidal template can be dissolved and an inverse opal pattern is unveiled. The holes in the micropattern are made up of bare conductive substrate surface to which another material such as gold can be electrodeposited into. Through a potentiostatic method, the electrochemical reduction of Au3+ to Au0 can be induced in these holes causing the accumulation of colloidal gold. The formation of polycarbazole-Au co-patterned surface has been extensively monitored using electrochemical quartz crystal microbalance (EC-QCM) and characterized using atomic force microscopy (AFM), X-ray photoelectron spectroscopy (XPS) and surface plasmon resonance spectroscopy (SPR). In addition, UV-Vis absorbance measurements revealed that the localized SPR peak of gold and polycarbazole polaronic peak are overlapping which can be a basis for future plasmonic applications. Lastly, the polycarbazole pattern can be selectively etched off thus leaving a highly patterned array of gold microparticles.
Acid reflux is a condition that causes people to regurgitate food after eating. Also known as Gastroesophageal Reflux Disease (GERD), this condition is caused by a weakening of the junction between the esophagus and stomach which causes the stomach contents to flow back into the esophagus. Several tests are currently used to diagnose acid reflux disease. These tests include x-rays of the upper gastrointestinal tract, often called the barium swallow test, an upper endoscopy, and the pH probe test. The most common test is the pH probe test. During this test, a thin, soft pH probe is inserted through the patient’s nasal cavity into the esophagus. The probe is implanted for 24 hours, during which the patient must stay in the hospital for monitoring. However, patients find the test uncomfortable and the hospitalization difficult. All of these diagnostic methods are less than ideal for children and adults as these tests would subject them to dangerous x-rays or anesthesia, are expensive, and uncomfortable. Due to these issues, it is critical to find a better detection method. Our solution would be to modify an existing pH probe using a magnetic coating that would be attracted to an external magnet. The probe could then just be swallowed and would detect esophageal pH without having to be implanted invasively. The pH probe would use a non-biodegradable coating that would safely pass through the digestive system.

Sixty percent of adults will experience acid reflux over the next year, with as many as 20-30% experiencing weekly symptoms. However, current detection methods are uncomfortable, expensive, and potentially dangerous. Therefore, it is critical to come up with an easy and inexpensive detection method.
Abstract

Sickle cell disease (SCD) affects 7% of the world population. The World Health Organization has declared SCD a public health priority. Of all SCD cases, 75% exist in African countries where there is almost no access to scientific equipment or modern societal infrastructure. Without access to these, SCD goes undiagnosed, especially in newborns. Around 50-80% of SCD infants die before they reach adulthood. There is a great need to diagnose SCD with a point-of-care device. This project optimizes a SCD point-of-care diagnostic device’s power supply and lab-on-a-chip interface. The previously designed lab-on-a-chip uses electrophoresis to separate hemoglobin bands which then can be analyzed with a smartphone camera to determine percentage sickle cell trait. The electrophoresis process requires a voltage source that can drive the separation of the proteins. In order to produce an accurate separated hemoglobin spectrum the interface between the lab-on-a-chip and the power supply needs to be optimized to protect the fragile graphite electrodes, secure the chip during the electrophoresis process, and withstand the harsh environmental conditions of Africa. The interface optimization will allow effective repeatability of electrophoresis in the field and enhance the diagnostic ability of the device. Improved diagnostics can lead to proactive disease treatment and awareness about the disease and consequently save the lives and improve the quality of life of SCD patients.
The Cleveland Digestive Diseases Research Core Center (DDRCC) is a cross-institutional and multi-disciplinary program, including 30 full members and 19 associate members from 16 different academic departments. The Center’s two major themes are Digestive Inflammation and Metabolism, both of which represent well-established areas of collaborative investigation at CWRU and CCF. The purpose of the Cleveland DDRCC is to (1) enhance the basic research capabilities of Center investigators, (2) develop and implement programs to support the independent development of young investigators in Digestive Inflammation and Metabolism research, (3) attract established investigators with varied expertise who are not currently involved in digestive disease research to apply their expertise to this important area of investigation and, (4) facilitate the translation of basic science research discoveries to the clinical arena.

Our Center offers three scientific cores, (1) Mouse Models Core, (2) Histology/Imaging Core, and (3) Biorepository Core. These core laboratories interface with a well-organized Administrative Core, which offers a Pilot/Feasibility (P/F) Program to promote innovative research projects by principal investigators who are new to the area of Digestive Diseases. In addition to the P/F Program, an Enrichment Program and Clinical Component are offered.
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 many heritable factors, although known risk variants account for a small portion of this heritability. Our lab has created a model of atypical inheritance to bridge the "missing heritability" gap.

Obesity is a worldwide epidemic and its comorbidities are the 6th leading cause for loss of health and life worldwide. Obesity is a complex disease with many heritable factors, although known risk variants account for a small portion of this heritability. 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 strain C57BL/6J and the obesity-resistant strain A/J. Using this approach, we identified the QTL Obq2a, inherited in a transgenerational paternal manner which confers resistance to diet-induced obesity. The Obq2a QTL interval was localized to 3.2 megabases on mouse Chromosome 6. I have created sub-congenic strains spanning Obq2a for higher resolution mapping. Preliminary analysis of the obesity susceptibility of the new congenic strains further localizes this QTL to a ~500 kb region. A series of backcrosses using the new congenic strains will determine how many generations diet-induced obesity resistance is conferred. Candidate genes in this region will be evaluated using RNA-seq and ChIP-seq to identify differential expression patterns and epigenetic marks, respectively. These studies will elucidate the genetic and epigenetic mechanisms associated with atypical inheritance of a metabolic disease.
The pupil is the black, circular area located in the center of the iris. It is essentially a hole in the iris and is the part of the eye that allows light to enter the retina. The iris is made of a ring of muscles that control constriction and dilation of the pupil. Pupils can either dilate or constrict as a response to various stimuli. In particular, our project will be focused on pupil dilation complications during cataract surgery. One main problem observed here is the onset of Intraoperative Floppy Iris Syndrome (IFIS) during surgery. This disease comes commonly from the enlargement of the prostate gland, which is known as benign prostatic hyperplasia (BPH). BPH medications (alpha-receptor blockers) create muscle loss in the iris and poor pupil dilation preoperatively and during the actual surgery, which can be characterized by IFIS. Thus, our project will directly look at IFIS and BPH and design a disposable device that will provide better control of the iris and pupil during cataract surgeries.

Dr. Eippert at Ophthalmic Physicians has a patent on a pupil dilating device concept he developed himself. His design is basically a mechanical ring that can hold the iris back during cataract surgery with patients who have IFIS. In the patent, there are several important components to this device that are highlighted. There are four footplates that will anchor the ring into the iris. Also, the ring has a 360-degree groove to maintain contact with the iris.

As for our design, we will look at more aspects to increase the design’s efficiency. The main inputs we will address are the device materials, adjustability of the ring, and ease of insertion. The main challenge will be to create a device this small that is adjustable and will take an insignificant amount of time in terms of the entire cataract procedure.
Oxidative stress is an imbalance between the production of free radicals and the ability of the body to detoxify their harmful effects by antioxidants. Increased oxidative stress alters tumor development as well as drug responses. Reports suggest that an increase in reactive oxygen species stimulates genes viz. FoxO3a and Klotho. The Klotho gene controls stress-induced senescence while the FoxO3a, is involved in antioxidant, anti-proliferation of tumor cells. Our group has shown transgenic adenocarcinoma mouse prostate (TRAMP) model and human prostate cancer cells have lower levels of FoxO3a expression. Here we examine the possible role of Klotho and FoxO3a protein in the inhibition of prostate cancer progression using the natural agent rhamnetin in TRAMP mice model. Feeding TRAMP mice orally with 10 and 20 µg per day (gavaged in 0.2 mL vehicle with 0.5% methyl cellulose and 0.025% Tween 20) for 6 days a week for 16 weeks starting at the mice age of 8 weeks represented reduced tumor growth. Intake of rhamnetin in mice led to significant increased expressions of klotho, Nrf2 and Shc66 in dorso-lateral prostate, which represented increased antioxidant potential. Reports suggested that secretory klotho binds to multiple FGFRs with different affinities. Additionally TRAMP mice represented significantly increased FGFR1 expression levels in the dorso-lateral prostates, which were reduced significantly after feeding rhamnetin. Moreover, inhibition of FGFR1 expression caused significant reduction in p-Akt (Ser-473) and ERK ½ phosphorylation levels with rhamnetin fed mice than control. This led to increased FoxO3a levels in both cancer cells and TRAMP model. Next we observed increased Bim expression, with reduction in Alix expression, which forced cells towards apoptotic events in rhamnetin fed mice. In addition, LNCaP and PC-3 cells showed restoration of Klotho and FoxO3a in the cells. We have discovered that rhamnetin may be an effective agent against prostate cancer.
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. JQ1 is a small molecule inhibitor of BRD4 that disrupts BRD4 interactions with acetylated histones. We have found that loss of BET function reduces the growth of TNBC cells both in vitro and in vivo. 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. It has been previously shown that 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 polyplody 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.
TGF-B Upregulates GSK3B and Mediates NK Dysfunction in Cancer

Abstract

Transforming growth factor-B (TGF-B) is an important regulator of tumorigenesis. TGF-B’s anti-cancer activity include promoting apoptosis and preventing hyperproliferation of cells. However, elevated TGF-B in the tumor microenvironment is known to hinder cancer eradication by suppressing anti-tumor activities of immune cells (Pickup et al., 2013). The regulators of TGF-B are not fully understood. One main target of TGF-B-mediated immune cell dysfunction are natural killer (NK) cells. NK cells are innate immune cells that lyse tumor and virally-infected cells. We observed upregulated GSK3B with TGF-B treatment. GSK3B inhibition has been linked to increased sensitivity of cancer cells to NK killing but the role of GSK3B in NK function is understudied. This study examines how TGF-B regulates GSK3B and NK cell function.

Methods:
NK cells were isolated from the peripheral blood of healthy donors and expanded in vitro for 14 days (Somanchi et al. 2011). NK cells were either treated with or without 5ng/mL TGF-B for 72 hours, and GSK3B expression, and the expression of NK activating receptors was measured via flow cytometry.

Results:
TGF-B treatment led to increased GSK3B expression in NK cells. TGF-B did not lead to a substantial decrease in the NK activating receptor Nkp44. In contrast, TGF-B pretreatment led to decreased expression of NK activating receptors Nkp46 and NKG2D. Also, TGF-B led to decreased expression of lymphocyte function-associated antigen-1 (LFA-1), which is an adhesion molecule necessary for NK cells to adhere to target cells prior to lysis of the target cells.

Discussion:
Our data suggests that TGF-B leads to upregulated GSK3B expression, and downregulation of a number of NK activating receptors. We believe that TGF-B-mediated NK dysfunction is facilitated by GSK3B upregulation. Further studies are underway to determine how TGF-B affects the expression of other NK receptors, and to elucidate the mechanism by which TGF-B directs GSK3B upregulation.
Unveiling Microcephaly Mechanisms Associated with DNA Repair Disorders using Induced Pluripotent Stem Cells and Cerebral Organoids

Microcephaly is found in isolated or syndromic forms of neurodevelopmental diseases and may be associated with brain structural abnormalities, intellectual disabilities and seizures. Mutations in DNA repair genes lead to microcephaly, demonstrating that the maintenance of genomic stability is crucial for proper brain development and size. However, its pathogenesis is poorly understood.

We generated induced Pluripotent Stem Cells (iPSCs) from healthy control patients as well as microcephalic patients with known mutations in the DNA repair pathway genes LIG4, PNKP or NBN. We used these iPSCs to generate neuronal precursor cells (NPCs), cortical neurons, and 3D cerebral organoids, which allowed us to study proliferation, apoptosis, differentiation and early self-arranged neuronal structures in organoids.

Our results indicate that causative mechanisms of DNA-repair-related microcephaly arise during early stages of brain development. Specifically, we found that NPCs derived from LIG4-iPSCs prematurely differentiated into neurons, and also displayed increased apoptosis. In addition, when directly differentiated into neurons, LIG4-iPSCs differentiated more rapidly compared to control cells. However, 2 weeks after transduction, the LIG4 neurons displayed increased cell death compared to controls. Finally, LIG4 cerebral organoids were 2 times smaller than the control organoids during the first 4 weeks of formation. Immunostaining of LIG4 organoid sections showed an increase in cleaved Caspase3 compared to the controls, further supporting a role for apoptosis in microcephaly. In summary, we were able to recapitulate human microcephaly due to mutations in DNA repair genes in vitro. Our models suggest that premature differentiation of NPCs followed by apoptosis of neuronal cells might play a significant role in DNA repair-related microcephaly. We believe that these models will allow us to further dissect important mechanisms underlying the pathogenesis of DNA repair-related microcephaly.
In recent years, wild giraffe (Giraffa camelopardalis) have been faced with a novel threat in the form of Giraffe Skin Disease (GSD), a newly discovered illness characterized by scab-like wounds on the body, manifesting mainly on the legs, neck, and chest of an animal. This study sought to determine the natural differences and variation in locomotor gait characteristics that occur within giraffe populations to create a baseline for further motion studies in the context of GSD. To do so, this study analyzed the motion patterns of six healthy giraffes housed at Cleveland Metroparks Zoo. Subjects were recorded using a high speed video camera while walking on varying substrate angles. In each study subject, three measurements were obtained during locomotion: (1) the angles of the wrist and ankle joints to assess flexibility in the appendages, (2) the back to vertical angle to determine relative spinal position and movement, and (3) neck to vertical angle to characterize position and movement of the head and neck. Significant differences were noted in the motion of the different groups of study subjects including differences in the minimum wrist joints and forelimb time off of the ground. In addition, the data displayed a trend of decreasing minimum leg joint angles with increasing deviation of the substrate angle from 90°. It is clear that multiple variables dependent on the features of the individual comprise giraffe locomotion. Therefore, factors such as age and sex should be considered when determining gait abnormalities. Techniques developed while examining the zoo-housed giraffes in this study will be applied to healthy wild giraffes as well as wild giraffes with GSD to ascertain the impact of the illness on normal giraffe locomotion. This is a crucial first step to understand the extent to which GSD threatens the ability of giraffe to maintain normal patterns of locomotion.
Antibiotic resistant bacteria, including Methicillin Resistant Staphylococcus Aureus, MRSA, pose a global public health concern. Therefore it is important to develop alternate strategies to combat these bacterial pathogens. We developed small molecule compounds to turn off the production of bacterial toxins. This approach shows promise as an alternate strategy for treating these dangerous pathogens.

We measured the efficacy of our small molecule compounds to inhibit virulence in MRSA in a number of in-vitro assays and in-vivo using insect larvae and mouse models. Quantitative PCR show that the compounds significantly downregulate known MRSA virulence genes without affecting bacterial growth. Initially shown to inhibit MRSA virulence and biofilm formation, we have now extended our studies to include other gram positive bacterial species. This approach shows promise as an alternate strategy for treating these dangerous pathogens.
The aim of endodontic therapy is to maintain tooth function and prevent periapical disease. Various factors have been shown to affect the survival of root canal treated teeth (RCTT). However, the effect of the opposing dentition has not been thoroughly investigated on the survival of RCTT. It has been suggested that RCTT opposing natural dentition are associated with a significantly lower survival rate compared to those opposing a fixed partial denture (FPD). Objective: To verify if different types of opposing dentition might affect the survival of RCTT. Hypothesis: We hypothesized that the presence/type of opposing dentition would affect the survival of RCTT. In the present cross sectional retrospective study, 400 RCTT restored with crowns were included from a computerized analysis of dental school patients who received root canal treatment from 2010-2015. Data collected included date of root canal treatment, type of the opposing dentition, whether RCTT were extracted and if so, the date of the extraction. Data was analyzed using Multinomial Regression (\( p=0.05 \), SPSS Ver.21). RCTT occluding against FPD was significantly associated with 5.3 times greater chance of extraction compared to RCTT with no opposing dentition (\( p=0.001 \), \( \text{Exp}(B)=5.34 \)). However, there was no significant difference in the survival of RCTT opposing natural dentition compared to those with no opposing dentition (\( p=0.78 \)).Conclusion: Based on our findings which are contrary to previous studies, it might be speculated that a well designed FPD that simulates the harmonious occlusion of natural dentition can be one of the factors that would increase the survival of RCTT opposing FPD.
Our project aims to create a device which makes playing music accessible to all pain patients. The keys on a keyboard will be remapped to play notes from the pentatonic scale. The patient would then be able to press any keys and still produce a melody that would help in alleviating the amount of pain they experience.

Music therapy is a promising non-pharmaceutical method for pain management. Playing the keyboard is not a widely possessed skill. This device would allow anyone to play the keyboard and produce a soothing melody, thereby relieving pain in an accessible and low-cost manner.
Abstract

Purpose and background/significance. Heart failure (HF) is a disabling chronic condition that affects almost 5.8 million people in the United States and over 23 million worldwide, with 550,000 new cases occurring each year. Medication adherence is essential for successful self-management. Adults with HF have sleep disturbance, which may lead to poor medication adherence and worsen quality of life (QOL). The purpose of this study was to examine the relationships among excessive daytime sleepiness, medication adherence and QOL.

Theoretical/conceptual framework: The Ryan and Sawin Model of the Individual and Family Self-management Theory guided the study. The model includes the relationships among context, cognitive mediators, and proximal and distal outcomes.

Method: This was a secondary analysis using a cross-sectional descriptive design. Adults with HF (N=372) were assessed for daytime sleepiness with the Epworth Daytime Sleepiness Scale, QOL with the Kansas City Cardiomyopathy Questionnaire, and medication adherence with an electronic bill box that included four HF medications.

Results: Participants were 59.7 % male and 40.3% female with an average age of 68 years. Twenty-two percent of the sample had daytime sleepiness, 35.6% were non-adherent and nearly 12% of the patients adhering to 50% or less of their daily medications, and 15.4% had poor QOL. Significant relationships were found for daytime sleepiness (M= 7.48, SD= 4.05) and medication adherence (M= 78.39, SD= 24.37, r= -.19, p=.001), and daytime sleepiness and QOL (M=74.68, SD= 21.53, r= -.31, p=.001). Conclusion: Adults with HF and daytime sleepiness have poorer medication adherence and QOL. Such findings extend past work by highlighting the importance of daytime sleepiness as an important factor in persons with HF; Future studies are needed to determine the possibility that intervention for daytime sleepiness may also improve medication adherence and QOL in this high-risk population.
In 2008, 636,346 ex-offenders were released from prison, within five years of release, half were incarcerated. With the influx of inmates being released, and the high recidivism rate, there is a renewed focus in developing rehabilitative programs within and outside of the prions to assist inmates with their reentry process.

Unless facing a life-sentence, individuals in prison will return to the community. It is imperative to understand the factors leading to incarceration in conjunction with needs upon release. By advocating for standardization of transition planning, plans become the proxy by which challenges that perpetuate instability are illuminated and addressed.

Researchers highlight the dearth of available research to support effective reentry planning policy process and the implementation, and systemic issues associated with the lack of effective standardized reentry planning processes. Researchers propose a model reentry planning process, including elements of a prototypical reentry plan, inclusive of strategies for engaging clients prior to release.
Title: Epigenetic Regulation of Maspin in Human Prostate Cancer

Author Status: Undergraduate student
Author Affiliation: Case Western Reserve University
Published?: False
Presentation Type: Poster

Elevator Speech: Understanding the intricate relationships between these molecules will provide a better understanding of metastatic progression of prostate cancer and development of novel therapeutics.

Key Words: prostate cancer, maspin, metastasis, p53, histone deacetylases

Abstract

Prostate cancer prognosis is dependent on many factors such as time of diagnosis, histological type, and degree of invasion. Loss of maspin (SERPINB5), a unique member of the serpin (serine protease inhibitor) family, is probably the first step in the development of metastatic cascade. Maspin is a secreted protein encoded by a class II tumor suppressor gene shown to regulate cell motility, invasion and tumor metastasis. Loss of maspin has been frequently identified in clinical prostate cancer specimens and prostate cancer cell lines, therefore mechanistic understanding of its loss will lead to new perspectives to develop novel therapeutics. We first performed studies on benign and prostate cancer specimens to demonstrate progressive loss of maspin expression which correlated with increasing Gleason score. Maspin promoter methylation and deletion analysis on tissue specimens did not contribute to the loss of maspin. Treatment of human prostate cancer DU145 and LNCaP cells with sodium butyrate and trichostatin A, inhibitors of HDACs, resulted in marked increase in maspin expression and acetylation of H3/H4 histone proteins, as a consequence of downregulation of Class I HDACs. Individual knockdown of HDAC 1, 2, 3 and 8 in LNCaP cells caused an increase in maspin expression which was more pronounced in HDAC 1, 3 and 8 knockdown cells followed by increase in p53 expression. Introduction of p53 with viral vector in PC-3 cells lead to increase in maspin expression. ChIP assay further confirmed silencing of class I HDACs in LNCaP cells facilitated the association between maspin and p53. HDAC 1-8 knockout cells exhibited slow migration ability, compared to LNCaPshV cells. These results demonstrate that loss of maspin is due to upregulation of class I HDACs and HDAC inhibitors led to increase in maspin expression and activity, in part, mediated by p53 activation in prostate cancer.
Abstract

There is considerable interest in flow batteries to meet energy storage requirements. Flow batteries can be used to store excess energy from intermittent energy sources, such as wind and solar. The all-iron flow battery under study is safe and inexpensive as compared to other flow batteries on the market.

An alternative approach involves eliminating a plating reaction by using electrolytes with ligands as coordination complexes with Fe²⁺ and Fe³⁺. Ligands can be used to tune the electrode potential of a redox couple, thus offering a wide operating potential between half cells. Successful coordination complexes must be stable, highly soluble and exhibit reasonable electrode kinetics. The pH of the electrolytes on either side of the membrane should be close and their conductivity and viscosity should be favourable.

In this study, a number of ligands were investigated as coordination complexes with iron as electrolytes in the all-iron flow battery. The kinetic rates for each of the complexes were measured using voltammetry, electrochemical impedance spectroscopy, and current measurements at constant potential. Solubility, pH, and conductivity was also measured. Suitable electrolytes were cycled in a flow battery with optimized flow configuration.

Dynamic magnetic resonance imaging (MRI) captures motion by acquiring images sequentially at a high framerate. Due to its inherently slow data collection, MR images must be undersampled in order to obtain images fast enough. Data acquisition without loss of image quality has led to the use of strategic through-time sampling patterns to exploit joint spatial and temporal information. k-t BLAST is a technique that works in the combined spatial-temporal frequency domain (x-f space) to resolve aliasing caused by through-time (k-t) Cartesian undersampling. Due to a lattice k-t sampling pattern, aliasing patterns in the x-f space are predictable and therefore can be resolved using a training dataset. a-f BLAST presents a non-iterative extension to dynamic radial imaging by using the radial symmetry of the data to simplify the reconstruction. Unlike Cartesian data, radially sampled data does not produce aliased images with the required artifacts. However, by performing a Fourier transform along the read-out direction and a subsequent Fourier transform along the projection direction aliasing artifacts similar to those seen in Cartesian k-t BLAST appear. This “aliased space” can then be Fourier transformed through-time to obtain a type of x-f space (a-f space) where the necessary aliasing is present to perform the k-t BLAST reconstruction. Results show that a-f BLAST reduces the radial artifacts from a retrospectively undersampled cine dataset as well as prospectively accelerated datasets (R=4) without compromising the temporal resolution in the through-time image space. a-f BLAST, or non-iterative non-Cartesian k-t BLAST performed in Radon space, has the potential to enable significantly faster reconstruction of radially undersampled images by removing the gridding/degridding steps usually required to come back from a radial sampling pattern.
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. Showcase your research in the Digital Case Collection. Digital Case serves as an online repository of the University’s intellectual achievements, and allows the university to assume a more active role in the scholarly communication process. Faculty and research staff may deposit their research knowing it will be processed, preserved and made available in this secure digital institutional repository and archive of the university. The Library provides the expertise such as metadata tagging, authority control and preservation over time for access and distribution of Case's collective intellectual product.
Health Improvement Partnership-Cuyahoga (HIP-Cuyahoga) is a consortium focused on improving health in four strategic areas in Cuyahoga County. One of these strategic areas is chronic disease management. The Chronic Disease Self-Management Program (CDSMP), developed by Kate Lorig at Stanford University, is an evidenced-based program for chronic disease self-management (CDSM). Research has documented numerous benefits of CDSMP. Those benefits include: increases in health behaviors, increased self-efficacy, improved health status and overall decrease in health care utilization. In 2014, HIP-Cuyahoga received funding from the Centers for Disease Control and Prevention (Racial and Ethnic Approaches to Community Health Grant) to focus on hypertension management among African Americans served by 9 safety net clinics in Cleveland and East Cleveland. One intervention involves clinic to community linkages (CCL), specifically related to CDSMP. Here we report the development of a process for using electronic health record (EHR) referrals to link patients from safety net clinics to lay-led CDSMP workshops. Our work suggests that the EHR is a useful tool to link patients to resources in the community for chronic disease self-management. During implementation, we identified several areas which require focused attention, including: 1) obtaining a signed business associate agreement for bidirectional feedback, 2) addressing concerns of extra workload burden by front line staff, and 3) using the EHR referral. To address these 3 areas, we have developed a replicable model for CCL CDSMP program implementation which involves the following: 1) obtaining a signed BAA for bidirectional feedback; 2) using an EHR referral to decrease work load burden for the front line staff; and 3) audit and feedback of referral data to practices monthly along with practice facilitation to enhance use of EHR referrals. The model also builds in data collection methods for program evaluation purposes.
The recent Ebola epidemic that started in West Africa in 2014 is the most widespread to date. There have been over 28,000 reported cases with around 11,000 deaths. The spread of Ebola from West Africa to other parts of the world is of great concern. Currently vaccines and treatments for Ebola are still in the developmental stage. Therefore, early detection and accurate diagnosis is critical to prevent the spread of Ebola. Current assays for Ebola detection use RT-PCR with synthetic RNAs as a positive control. The problem with these assays is that the positive control is prone to degradation, and there is no method to determine if sample processing errors have occurred, which may lead to false-negative results. To address this problem, we have devised a bio-inspired positive control for use in RT-PCR based Ebola diagnostics. We encapsulated scrambled Ebola sequences inside of tobacco mosaic virus (TMV) to create a biomimicry that is non-infectious, but stable. TMV is a filamentous rod-shaped plant virus that is of similar shape to the Ebola virus and will therefore mimic the Ebola virus in an assay. This positive control can be spiked into clinical and environmental samples that require testing to help eliminate false-negative results. Here, we report the bioengineering and validation of this probe. In addition to the development of a high-tech assay that will be used in laboratories, we also developed a low-tech assay that can be used in the field.
Understanding the Contributing Components to the Cellular and Molecular Phenotypes of Trisomy 21

Down Syndrome is caused by an extra chromosome 21, but exactly how that extra chromosome leads to the variable traits seen in patients is unclear. I will use several models with different levels of the extra chromosome 21 to investigate how they lead to changes in the cells.

Down Syndrome, or Trisomy 21, is the most common chromosomal disorder in humans, affecting about 1 in 700 live births. Affected individuals can have symptoms including mild to moderate intellectual disability, congenital heart and gastrointestinal defects, characteristic dysmorphic facial features, leukemia, and Alzheimer’s disease. Some components of the phenotype are due to the triplication and imbalance of specific genes on chromosome 21, termed the “gene-dosage effect”. However, it has also been hypothesized that some phenotypic manifestations are due to an overall chromosomal imbalance from excess genomic material in the nucleus, termed “developmental instability”. Additionally, the extent of gene expression dysregulation in Down Syndrome patient cells is poorly understood, and investigation is complicated by genetic background heterogeneity. To parse out the differing contributions of these mechanisms, and understand their impact on cellular growth and transcriptional profiles, I will utilize several forms of chromosome therapy in Down Syndrome patient-derived induced pluripotent stem cells to generate and compare isogenic cell lines with varying levels of trisomy 21. These will be fully trisomic cells, trisomic cells with Xist silenced supernumerary chromosome 21, cells with the supernumerary chromosome 21 removed through ring chromosome induction and loss, and cells with supernumerary chromosome 21 removed through use of selectable markers. These cell lines will be used to compare cellular phenotypes including proliferation rate and neural differentiation potential, which are hindered in Trisomy 21 cell lines. I will also subject the lines to RNA sequencing to compare their transcriptomes and identify expression dysregulation differences due to the differing levels of trisomy 21. Comparison of these models will provide important information about the genetic mechanisms underlying expression and growth dysregulation in Down Syndrome patient cells.
Every year, over 795,000 Americans have a stroke. Stroke Survivors can suffer from a variety of ailments including muscle paralysis, weakness, spasticity, and shoulder subluxation. Currently, there is a wide variety of treatments, therapies, and braces with the goal of aiding patients in recovery and everyday life. However, outside of therapy, current devices in the market can be difficult for patients to put on, which leads to lack of use and therefore ineffective arm supports. Our goal is to create a device that will not only be user friendly, but also aid arm lifting at the shoulder. Typically, a stroke patient would only have fully functional capabilities in one arm, which makes everyday tasks a challenge. To have the device user friendly, it will have a simple strap design that a patient can put on with one hand. A minimal amount and easily accessible straps will make donning and doffing less of a chore. Furthermore, attached to the support will be a simple mechanical system that will assist the patients in lifting their arms. A spring system will apply a constant upward force creating a “weightless” feeling. This effect will allow the patient to exert less effort in normal tasks, and therefore prevent unwanted spastic movements.
Objective:
There are varied methods and styles of teaching. To our knowledge, there is no published study in US that compares traditional didactic lecture format to interactive game style format like jeopardy. We conducted both teaching styles and compared how student's performed and their retention of knowledge.

Methods:
A cross-sectional study was conducted in the Department of Pediatrics at MetroHealth Medical Center in Cleveland, Ohio. A group of pediatric residents were taught different topics from ‘Smiles for Life Curriculum’ by the same teacher in jeopardy game style format and traditional lecture format. In both teaching formats, a pre test and post test was conducted and a second post test was conducted 2 months later, to assess for retention of knowledge.

Results:
20 residents participated in lecture format and the same 20 residents were taught in jeopardy game format. In both groups, pre test results showed no difference, while both showed an improvement in post test scores. The first post test results showed a significant improvement in performance with jeopardy style teaching. Retention of knowledge was significantly higher in jeopardy style teaching as showed by results of second post test conducted 2 months later.

Conclusion:
Interactive game style format of teaching showed better performance and an added advantage in retention of knowledge, when compared to traditional teaching method. Game format is a better method of education.
Triple negative breast cancer (TNBC) represents a small percentage of breast cancers, yet conveys the poorest patient prognoses due to the high incidence of metastatic recurrence. 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 are unknown. A meta-analysis of 684 estrogen receptor negative tumors revealed BCL11a expression to be highly and significantly correlated with transcription factors that control CSC fate, such as EZH2, SOX10 and FOXC1, suggesting that BCL11a may be part of a transcriptional network regulating tumor cell fate in TNBC. Transient silencing of BCL11a in the TNBC cell line, HCC1187 decreased expression of the CSC marker, CD44. Further, BCL11a knockdown reduced the CD44HI/CD24LO CSC population, substantiating the importance of sustained BCL11a expression for CSC maintenance. BCL11a reduction also increased cleaved caspase 7 and Parp1 as well as reduced cell viability. To determine the BCL11a-regulated transcriptome in TNBC, we performed RNA-seq analysis of control and transiently-silenced cells from 2 independent TNBC cell lines. This yielded 154 differentially expressed genes that were consistent between the two cell lines. Gene set enrichment analysis of the overlapping data set revealed enrichment of differentiated luminal-like breast cancer genes and altered mammary stem cell genes, including the splicing regulator, MBNL1. Recently identified as a suppressor of breast cancer metastasis, MBNL1 expression was increased with BCL11a knockdown and MBNL1 target genes were alternatively spliced, including SCRIB and NUMA1, known regulators of cell polarity and asymmetric cell division. These data are the first to identify the BCL11a-regulated transcriptome in TNBC and may reveal a novel role for alternative splicing in regulation of CSC properties in this disease.
The amphiphilic star-like copolymer polyethylenimine-block-poly(ε-caprolactone) (PEI-b-PCL) was utilized to transfer the pre-synthesized citrate-capped noble metal nanoparticles (NMNPs) from an aqueous layer to an organic layer without any additional reagents. Dynamic light scattering (DLS) and transmission electron microscopy (TEM) were utilized to study the assembly of the polymers coated on the surface of the citrate-capped NMNPs. After removing the organic solvent, the polymer-coated NMNPs in powder form (PCP-NMNPs) were obtained. The excellent solubility of the PEI-b-PCL allows the PCP-NMNPs to be easily dispersed in most of the organic solvents without any significant aggregation. Moreover, the good thermal stability and long-term stability make PCP-NMNPs an excellent NMNP-containing hybrid system for different specific applications, such as surface coating, catalysis and thermoplastic processing of nanocomposite materials.
Flow reactor was used to synthesize free polymers and graft polymer chains from the surface of silica particles. Reversible addition-fragmentation chain transfer polymerization was chosen to do the polymerization. In order to modify the silica's surface, new kind of silane-modified CTA was synthesized. Because of the "flow" feature, the processes of modifying the micro-particles and doing polymerization were much more simple and easier than using the batch reactor. And the PDI for polymer chains was much lower than using conventional method. Since RAFT was used to do the polymerization, it will also be easy to synthesize block co-polymers on the surface of the particles just with changing the reactant containers and without further purification. TGA, FTIR, GPC, IR and NMR were used to characterize the grafted polymer chains.
Big data and integration of series of omics technologies carry great potential for elucidating the genetic underpinnings of longevity, hence healthy aging. Unfortunately, while genome-wide association studies using unrelated individuals have revealed many interesting aging associated variants, these variants are typically of small effect and cannot explain the observed patterns of heritability for this complex trait. Even though there is great potential in large scale approaches, none so far have produced reproducible results. In contrast numerous successful examples exist for elucidating the highly penetrant rare segregating alleles that have been discovered using family based approaches. Furthermore, family based approaches have other advantages: the ability to overcome confounding factors such as population stratification. We conducted a family based approach to longevity using founder population of the Amish community in central Ohio. As the heritability of longevity is estimated be 40 percent it is a highly interesting research domain in this population. Our design study using a single large multi-generation pedigree to directly measure heritability together with phenotypic traits and epigenetic variation is unique and powerful. The genetics have an added layer of complexity at all stages from design to analysis nevertheless the findings are of high value. Heritability was assessed using multiple contrasts: parent-child, mid-parent-child sibling-sibling and grandparent-grandchild. The present approach integrates both phenotypic and genotypic approach which has led to discovery of a series of variants, distinct for stratified population across ages and distinct for paternal and maternal cohorts. The potential significance of this study is profound.
Epistasis is defined as a statistical interaction between two or more genomic loci in terms of their association with a phenotype of interest. Epistatic loci that are identified using data from Genome-Wide Association Studies (GWAS) provide insights into the interplay among multiple genetic factors, with applications including assessment of susceptibility to complex diseases, decision making in precision medicine, and gaining insights into disease mechanisms. Since the number of genomic loci assayed by GWAS is extremely large, identification of epistatic loci is a statistically difficult and computationally intensive problem. Even when only pairwise interactions are considered, the size of the search space easily reaches into billions of locus pairs. The large number of statistical tests performed also makes sufficient type one error correction imperative. Consequently, efficient algorithms are required to filter the tests that are performed and evaluate large GWAS data sets in a reasonable amount of computation time. It has been observed that many pairwise tests are ultimately redundant due to correlations in their genotype values across samples, known as linkage disequilibrium. Here, we propose a new algorithm for fast epistasis detection based on hierarchical representation of linkage disequilibrium. We utilize redundancies in genotype patterns between neighboring SNPs to generate a hierarchical structure and execute a branch-and-bound search to prioritize loci testing based on approximations of a test statistic for pairs of loci groups. This hierarchical organization allows for exceptionally efficient scaling based on the density of the loci provided. We test our algorithm comprehensively on three data sets obtained from the Wellcome Trust Case Control Consortium. Our results show that we are able to drastically reduces the number of tests performed while discovering statistically significantly interacting loci pairs.
Kangaroo Care Education Effects on Nurses’ Knowledge and Confidence

Abstract

Purpose and background/significance. In 2014, < 20% of the 996 NICUs in the United States provided routine Kangaroo Care (KC), due to inadequate knowledge and confidence about KC because KC is still new to many nurses. Knowledge and skill acquisition are needed to increase practice. The study was conducted to determine the effects of a KC continuing education course on knowledge and skill confidence.

Theoretical/conceptual framework: Roger’s Innovation Diffusion Model was used because the first step in diffusion of a treatment is knowledge and skills acquisition. Knowledge was conceptually defined as “information, understanding, or skill that you get from personal experience or education” and operationally defined as the degree of agreement to Likert-based statements of KC effects in infants and mothers. Confidence was conceptually defined as “a feeling of self-assurance arising from one’s appreciation of one’s own abilities or qualities” and operationally defined as degree of agreement to Likert-based statements of feelings of confidence about clinical practice of KC.

Method: A one group pretest-posttest quasi-experiment was conducted. The Kangaroo Care Knowledge and Confidence Tool (a PI-developed Likert scale 36-item questionnaire [20 Knowledge, 8 Confidence items with established content validity], scoring items as strongly disagree =1 to strongly agree=5) was given to all 68 registered nurse attendees before and after a 2.5 day KC course focusing on KC evidence and skills. Fifty-seven complete questionnaires were returned; power analysis mandated 54 data sets for alpha =0.05, power =0.80, and effect size 0.4. Measures of central tendency, dispersion, and two-tailed paired t-tests were conducted.

Results: Characteristics of the nurses varied widely. Post-test Knowledge score ($M_{88.54}$, $SD_{6.13}$) was higher than pre-test Knowledge score ($M_{78.7}$, $SD_{8.30}$), $t$ (54) = -9.1, $p=0.000$. Post-test Confidence score was higher ($M_{32.06}$, $SD_{3.49}$) than pre-test Confidence score ($M_{26.80}$, $SD_{5.22}$), $t$ (53) = -8.459, $p=0.000$. Cronbach alpha for Knowledge was 0.81 and for Confidence was 0.80.

Conclusion: KC Knowledge and Confidence improved in registered nurses after the program, supporting the effect of education...
Knudsen effusion mass spectrometry (KEMS) is a widely used technique for measuring the thermodynamic properties of materials at high temperatures. Geological applications of KEMS include determining activities of silicate melts and measuring isotope ratios for K-Ar dating. For all mass spectrometry, it is important to ensure a representative sample of source material is introduced into the ionizer for measurement. A model was developed to simulate the flow of molecules in a Knudsen cell mass spectrometer in order to develop better sampling systems and improve data quality.

Abstract

Knudsen effusion mass spectrometry (KEMS) is a widely used technique for measuring the thermodynamic properties of materials at high temperatures. Geological applications of KEMS include determining activities of silicate melts and measuring isotope ratios for K-Ar dating. For all mass spectrometry, it is important to ensure a representative sample of source material is introduced into the ionizer. KEMS instruments use a series of collimating apertures to guide a low density gas from a vaporizing solid to the ionizer with minimal interaction with cold surfaces inside the vacuum chamber of the instrument. To more fully understand the issues surrounding molecular beam collimation, it was necessary to model molecular flow through the sampling system. Visual Basic for Excel was used to develop a Monte Carlo model to simulate the flow of molecules from the orifice of a cell containing vaporizing solid through the sampling system to the ionizer. The outputs of this code can be used to ensure a representative sample of vaporizing solid is measured at the ionizer using a wide variety of collimating geometries.
Polymer coatings with both superhydrophobic and superoleophilic properties are attracting increasing attention due to their various applications, including cleaning oil spills and creating anti-corrosion coatings. Organogels, in particular, can easily be tuned to have both properties and can very well be used to coat any substrate. In this study, we investigated the applicability and efficiency of the organogel-coated stainless steel mesh in separating oil and water. The organogel coating is prepared by using a facile and robust dip-coating technique in a solution consisting lauryl methacrylate, ethylene glycol dimetacrylate (EGDMA), trimethoxysilyl propyl methacrylate (TMS), 2,2-Azobis(2-methylpropionitrile) and toluene as a solvent. The wettability of the coating was studied by measuring the water contact angles when the organogel-coated mesh is immersed in different types of oil. Oil and water separation efficiency of this polymer coating was found to exceed 99% for all types of oils tested which include cooking oil, gasoline, kerosene, crude oil, and silicon oil. The purity of filtered oil was measured using quantitative infrared spectroscopy. The intrusion pressure of this polymer coating is also measured to demonstrate the ability of this polymer coating to withstand a great pressure.
A Coupled fluid-solid interaction model has been built to study the erodibility of soil in water. The coupled model is based on two different numerical methods: Computational Fluid Dynamics (CFD) and Discrete Element Method (DEM). This model is able to describe solid and fluid fields in meso-scale and provides an insight into the erosion mechanism for both cohesive and non-cohesive soils. Firstly mono-sized soil particles with diameters of 2.0 mm are generated inside a pipe, and water flows along the pipe under different inlet pressure. Influencing factors of soil erodibility, including particle diameter and inner-particle adhesion, have been discussed in detail. Then a macro-scale definition of shear stress for sand particles, which equals to the ratio of drag force over particle’s effective area, has been verified by Moody chart and shows a good accuracy. For non-cohesive soils, the critical shear stress is linearly related to particle size. For cohesive soils, inter-particle adhesion largely decelerates erosion process. In this case, with the increase of adhesion, particle average velocity decreases from 0.162 mm/s to 0.128 mm/s. So the critical shear stress cannot be evaluated based on a short time simulation, which requires more discussions in the future. To study the influence of turbulence, a k-? model finally has been implemented into the fluid field. A comparison between laminar and turbulent models show that erosion rate in turbulent model is five times faster than that in laminar model. Drag force and particle velocity can be one order of magnitude larger than that in laminar condition.
This presentation outlines how a way WAY out of print book can be brought back to life for all to enjoy!

The year is 1897 and eccentric millionaire William J. Hypperbone has died! The terms of his will dictate 6 players be randomly chosen to compete for the $60 million inheritance. To win they have to play his favorite board game “The Noble Game of the Goose” but on a much grander scale – a race around the country in “The Noble Game of The United States of America”! Which of these brave adventurers will have the luck of the dice (and circumstance) to win “The Will of an Eccentric”?

Verne is as brilliant as ever here; he takes the Baedecker guidebook for the United States, which had only recently been published, and incorporates it into his narrative. The book alternates between the description of plot & action with the description of places & culture. It is not just a fun adventure, but a look at America (and Americans) through the eyes of a European at the end of the 19th century.

Jules Verne’s epic adventure around the United States was never published in the US during his lifetime and this modernized edition brings this obscure book to a new generation.

This Modern Edition is a scholarly work and not just a straight reproduction of the 19th century British edition. Modern means the reader won’t need a dictionary to search for obscure and obsolete 19th century terms (which most of the time were British choices for French words). When first published, the book contained many logical inconsistencies and continuity errors that have also now been resolved. As with any scholarly edition, all changes have been carefully documented and annotated. These changes, along with the correction of typos & translation errors create a thoroughly enjoyable reading experience that remains true to the Verne original.
Our preliminary equivalent width and column density measurements for Mg-II ions and Na-I atoms in the circumgalactic medium (CGM) surrounding 11 star-forming low-z galaxies and their background quasi-stellar objects (QSOs) sourced from the COS-Halos survey have cast doubt on the conjecture that baryons in the circumgalactic medium are sourced primarily from superwinds generated by star-formation and supernovae. CGM equivalent width measurements for Na-I had an average value of < 0.13 Angstroms, while for Mg-II, measurements had an average value of 0.50 Angstroms. These measurements are an order of magnitude lower than their counterparts measured down the center of galaxies in established literature. In light of these precursory results, we aim to supplement our progress by analysis of Na-I equivalent width and column density measurements, ionization modeling of Na-I, Mg-II, Mg-I, and other related ions, constructing and testing physical wind models against observations, and comparing simulated absorption spectra of low-z galaxies to observations. This will be supplanted by extending these analyses to galaxies at a range of cosmic epochs with varying intrinsic masses, star-formation rates, environments and other intrinsic properties to further elucidate the role of galactic superwinds in the evolution of the CGM.
Investigating the Design Of Gold Nanoparticles To Target Difficult-To-Reach Tumor Sites

Elevator Speech
Brain cancer is the second most common cancer in children, and 20-40% of all breast cancer metastasize. Glioma is specifically hard to target because of the blood brain barrier and sites of metastasis are hard to target once entered in the bloodstream and lymph system, making nanoparticles a more attractive alternate to access these difficult sites.

Abstract
Certain cancers (metastatic breast cancer, invasive glioma) are deadly because of their inability to be treated using existing methods. For example, metastases are buried within other tissue and the blood-brain barrier limits access to the brain. Nanoparticles, can be engineered to access these areas. In previous studies, iron oxide nanochains have shown significant therapeutic effect compared to spherical nanoparticles. Further investigating the design (shape, size, flexibility) of the particles, will give insight into how these attributes can govern the efficiency of these drug-carrying particles to reach these tumor sites. Although literature shows gold and iron oxide function similarly, gold is easier to synthesize in mass quantities. The hypothesis involved two aspects: finding an effective method to synthesize gold particles, and testing these structures. First, spheres and chains were fabricated and attached to the tripeptide-targeted ligand. These shapes were tested in three in vivo mouse models of breast cancer and glioma (n ? 3). The gold particles were analyzed and imaged for size and shape using a transmission electron microscopy. The amount of gold per organ was measured after digesting the organs, liver, spleen, kidneys, lungs, brain, tumor, using inductively-coupled plasma optical emission spectrometry. A large percentage of targeted spheres have not shown significant drainage in any of the models. Data from in vivo mouse models using chains are still being collected. In conclusion, ongoing studies suggest that targeting strategies can be custom-engineered to reach difficult-to-target tumor sites, and future studies will focus on the comparison between chains and other structures.
The ketogenic diet (KG) is a high-fat, low-carbohydrate diet, which mimics fasting and results in the hepatic production of ketone bodies that are utilized by peripheral organs as the predominant energy substrate. KG is a well-established, non-pharmacological approach to treat drug-resistant epilepsy in children and has shown promise in treating other neurological conditions such as Alzheimer and stroke. The mechanism through which KG confers neuroprotection is still largely unknown, but studies have implicated KG in modulating cell-signaling pathways that are cytoprotective. The primary signaling pathways include AKT, HIF-1a, and AMPK, and these pathways have been suggested to have overlapping signaling targets. Interestingly, we previously established that KG leads to accumulation of hypoxia-inducible factor 1-alpha (HIF-1a) in the rat brain. The goal of this study was to establish the effect of KG on well-established regulators of cell growth and survival; in addition, we sought to define whether these effects were dependent on circulating and brain tissue concentrations of metabolites. Cortical brain tissue from mice fed either a standard diet (STD) (27.5% kcal fat) or KG (89.5% kcal fat) was analyzed by Western Blot to detect for levels of HIF-1a, total and phospho-AKT, total and phospho-AMPK, and total FOXO3a. Our results demonstrate that the KG group exhibited significant upregulation in AMPK phosphorylation and downregulation in total FOXO3a levels. Although a trend of increased HIF-1a levels and decreased AKT phosphorylation was noted with KG, it was not significant. However, circulating ketone levels correlated with phosphorylation of AKT protein targets, suggesting a dose dependent effect on activity of signaling targets. Our work represents a novel finding with respect to post-translational regulation and implies a greater sensitivity of cellular signaling pathways to alterations in circulating metabolites than previous reported.
Inflammation plays an important role in the pulpal-periapical (PP) defense mechanism as well as pathosis and is characterized by marked elevation of inflammatory cytokines. Literature indicate that major PP inflammatory cytokines production are regulated through nuclear factor kappa B (NF-kB) pathway. Lipopolysaccharide (LPS) is a strong stimuli of NF-kB pathway which induce transcription of inflammatory cytokines genes and elevate the production of inflammatory cytokines and activate bone resorption. 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 production of inflammatory mediators through suppression of NF-kB pathways. Considering the opposite effects that activating agents like LPS and Lunasin exert on NF-kB regulatory pathway, the present study aimed to investigate the effect of Lunasin on the production of common pro-and anti-inflammatory cytokines (IL-1β, IL-6, IL-8, IL-10) through alteration of NF-kB pathway in LPS activated THP1 cell lines. We hypothesized that Lunasin can down-regulate the production of common inflammatory cytokines through suppression of NF-kB pathway in LPS activated THP1 cell lines.

Methods: In the present experimental study, THP1 cell lines that resemble human macrophages were used. After exposure to phorbol-12-myristate-13-acetate (PMA) THP-1 cells differentiated into a macrophage. Macrophages cell lines were then divided to a negative control group (LPS-activated macrophages), a positive control group (Ibuprofen treated macrophages) and 3 experimental groups including: a) 100m Lunasin b) 50m Lunasin c) 10m Lunasin treated groups. Level of inflammatory cytokines including IL-1β, IL-6, IL-8, TNF-α and IL-10 was analyzed using Luminex Bead-based Multiplex Assay. Data were analyzed using ANOVA and tukey’s post hoc test. Results: 100m and 50m Lunasin significantly reduced the production of TNF, IL-1 and IL-6 compared to LPS treated groups (p=0.002). However, there was no significant difference between Lunasin treated groups and Ibuprofen treated group (P=0.65). Interestingly, 100m Lunasin significantly increased the production of anti-inflammatory cytokine IL-10 compared to Ibuprofen. Considering the suppressive effect of Lunasin on production of cytokines responsible for inflammation and bone resorption (IL-6), the use of Lunasin as a potent intracanal medicament can be evaluated in further studies.
### Abstract

Long non-coding RNAs (lncRNAs) have emerged as powerful regulatory molecules in multiple cellular processes, suggesting that they can play an important role as tumor suppressors or oncogenes. Colorectal cancer (CRC) remains the third leading cause of cancer-related death due to high complexity and heterogeneity at the molecular level. We hypothesized that specific lncRNAs may be acting as oncogenes to drive colon tumor progression. To identify candidate oncogenic lncRNAs in CRC, we leveraged RNA sequencing data from 22 colon tumor and matched normal tissue samples from The Cancer Genome Atlas (TCGA), yielding ~200 differentially expressed lncRNAs. Following validation of differential expression in an independent cohort of normal colon and patient-derived colon tumor tissue, lincDUSP emerged as a notable candidate oncogenic lncRNA due to its consistently low expression in normal colon and high expression in a subset of colon tumors. Knockdown of lincDUSP in patient-derived colon tumor cell lines by LNA GapmeRs resulted in significantly decreased cell proliferation and clonogenic potential as well as increased apoptosis. These studies will be expanded to characterize the effects of lincDUSP overexpression in early-stage colon tumors.

In an effort to elucidate the mechanism of action of lincDUSP, we queried the transcriptome of cell lines with or without lincDUSP26 knockdown by RNA sequencing and identified ~500 differentially expressed genes. Using NCI pathway analysis, we found that this set of differentially expressed genes is significantly enriched for pathways involving DNA replication and repair. Consistent with these findings, cell cycle phase analysis demonstrated an increased apoptotic cell population and significantly increased S-phase population. Future studies will involve functional analysis of the role of lincDUSP in pathways related to cell cycle control and identification of functional intermolecular interactions.
The Partnering for Family (PFS) program seeks to safely reduce the number of foster care days among children whose families are homeless through collaborations formed between child welfare workers and homeless service providers. Findings from the program’s first year are explored, including the program model, sample characteristics, and impact.

Abstract

Background
In Cuyahoga County, Ohio, in order for children placed in out-of-home foster care to be reunited with their families, their caregivers must be able to provide a safe and stable home environment. Unfortunately, many of these caregivers are homeless and struggle with domestic violence, substance abuse, and mental illness. As a result, their children are profoundly impacted by the loss of consistent caregivers and spend significantly longer lengths of stay in out-of-home (OHP) foster care. This extended time in the child welfare system results in poor outcomes for the County’s most vulnerable families and high costs to the County. The Partnering for Family Success (PFS) program is designed to deliver intensive case management known as “Critical Time Intervention” (CTI) as well as access to family-appropriate housing. CTI helps fragile families that are experiencing homelessness to slowly reconnect to community support networks and settle successfully in newly attained housing. CTI is also paired with age-appropriate, evidence-based trauma services that will secure and strengthen healthy caregiver-child relationship. Eligible participants include female caregivers over the age of 18, who are homeless and have at least one child in OHP who is not in permanent custody at time of identification. The eligible participants are randomized for selection into either the treatment group or control group. While the treatment group and control group are all getting similar services through the child welfare system, the treatment group is getting housed more quickly and is provided with the CTI services.

The process evaluation of PFS assesses program implementation to date, and identifies factors that might be contributing to the program’s successes. It also provides recommendations regarding necessary adjustments to the program. Here, we focus on findings from the first year of the implementation study of PFS, and describe the program, sample characteristics, and indicators of the program’s impact.

Questions
The questions answered in this research include: (1) What is the PFS model? (2) What are the characteristics of families in the PFS treatment and control groups? (3) What early indicators help describe the program’s impact?

Methods
In order to address the questions, we used mixed methods. Specifically, we analyzed administrative data (Homeless Management Information System (HMIS) data) and qualitative interviews with staff working with the program. We conducted semi-structured interviews with workers from the Cuyahoga County Department of Children and Family Service (“DCFS...
S-Nitrosothiols are endogenous molecules with diverse cell-signaling effects with potential relevance to cystic fibrosis (CF). One class of S-Nitrosothiols, S-nitrosoglutathione (GSNO), is normally present in the human pulmonary airway. However, cystic fibrosis patients tend to have decreased GSNO levels. Several research groups, including our own, have reported that different S-nitrosothiols, including GSNO, increase the expression, maturation and function of wild-type and mutant F508del CFTR. Our previous work found that GSNO is corrector and a potentiator; in that it redirects CFTR to the cell surface and improves CFTR function. Our studies have indicated that the effect of SNO on CFTR maturation may be mediated via the degradation of of Hsp70/Hsp90 organizing protein (Hop), a co-chaperone of the major molecular chaperones Hsp70 and Hsp90. The precise mechanisms by which GSNO and related S-Nitrosothiols improve CFTR maturation are unknown. As such, the overall goal of this project is to define the novel mechanisms by which S-Nitrosothiols increase CFTR maturation at the cell membrane. Specially, we will test the hypothesis that CFTR maturation induced by S-Nitrosothiols involves molecular co-chaperone carboxy terminus of Hsc70 interacting protein (CHIP) in primary HAPCE cells. We believe that project will provide a novel approach looking at S-nitrosylation of CHIP as a key mechanism by which GSNO increases CFTR maturation and trafficking to the cell membrane.
Present study determines the effects of diosmetin (5,7-Trihydroxy-4'-methoxyflavone) as a chemo-preventive agent in prostate cancer. Diosmetin, a naturally occurring flavonoid present in citrus plant, has anti-mutagenic and anti-allergic properties. 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, no significant growth inhibition was observed in normal prostate epithelial cells (RWPE1). mTOR (mammalian target of rapamycin) is a serine/threonine protein kinase, regulator of cell growth, proliferation, motility, survival, and has two distinct complexes: mTOR complex 1 (mTORC1) and mTOR complex II (mTORC2). mTORC2, component RICTOR (rapamycin-insensitive companion of mTOR), plays an important role in phosphorylating Ser-473 of Akt/PKB, which allows full activation of Akt/PKB. We demonstrated induced expression of RICTOR by IL-6 and IGF-1 was inhibited by diosmetin in prostate cancer cells. Diosmetin (20?M) treatment to prostate cancer cells inhibited RICTOR nuclear localization, resulting in inhibited phospho-Akt (Ser-473), and in turn increased the nuclear presence of FOXO3a (Forkhead box O3) protein. Downstream of mTOR pathway, p70S6 kinase, which promotes cell growth and survival, was inhibited by diosmetin treatment. Moreover, diosmetin treatment caused alterations in the mechanisms of cell survival through down regulation of cell growth inhibitory molecules (viz., c-Myc, X-Linked Inhibitor of Apoptosis (XIAP), and Survivin) and down modulated Cyclin D1, cdk2 and cdk4, whereas KIP1/p27 and INK4a/p16 were increasing. Present study demonstrates increased apoptosis of LNCaP and PC-3 cells after diosmetin treatment, due to inhibited levels of RICTOR, alteration of the cell cycle, and disruption of the Akt signaling cascade. This is one of the first studies to determine the anticancer effects of diosmetin in prostate cancer cells.
Non-odontogenic pain is more common than once thought. As a result, dental care providers should familiarize themselves with diagnostic criteria and management of such disease in order to prevent unnecessary invasive procedures to patients who do not need it. Considering that more than 16.4 million root canal treatments performed annually in the United States, over half a million endodontic patients would be at risk for non-odontogenic pain. The present case report will highlight the importance of differentiating between odontogenic and non-odontogenic pain in attempt to prevent needless dental treatments.
### Abstract

Repair of articular cartilage can benefit millions of individuals who suffer from osteoarthritis. Stem cell-based engineered cartilage constructs offer a promising solution. Chondrogenesis can be induced in human mesenchymal stem cells (hMSCs) derived from adult bone marrow by transforming growth factor-β (TGF-β) in vitro, but the biochemical and biomechanical properties of the resulting cartilage constructs are inferior compared to native tissue. The goal of this study is to develop strategies to bridge this gap in tissue constructs. Previous research indicated that inhibition of canonical Wnt signaling can enhance chondrocyte differentiation. RhoA/ROCK signaling, downstream of non-canonical Wnt signaling, was also found to drive hMSC commitment between adipocytes and osteoblasts, but its role in chondrogenesis is still unclear. We hypothesized that suppression of RhoA/ROCK signaling in hMSCs can enhance chondrogenic differentiation under TGF-β induction. To test the hypothesis, we treated hMSCs with Y27632 to inhibit the expression of ROCK upon TGF-β1 induction in aggregate culture. We analyzed construct size, measured GAG and collagen content, and carried out histology and immunohistochemistry (IHC). The results show that inhibition of ROCK directed the fate of hMSCs toward chondrogenesis and led to enhanced chondrogenesis evidenced by increased GAG (33% greater) and collagen (18% greater) content, and larger constructs (199% greater). These increases were dependent on the exposure regime with the regime that included early stages of differentiation led to the best outcomes. Since RhoA/ROCK signaling is involved in myosin-II light chain phosphorylation, we hypothesized that actin cytoskeleton contraction regulation is required for proper chondrogenic differentiation. We carried out traction-force microscopy experiments to measure traction stresses produced by hMSCs under the conditions of growth maintenance (control), chondrogenic induction and RhoA/ROCK signaling inhibition. The traction stresses increased by about 1.7 fold during chondrogenic induction when compared to controls, whereas ROCK inhibition led to only 1.2 fold increase in stresses compared to controls. Our findings indicate that repression of cytoskeletal tension thus regulating spontaneous cell rounding and contraction during early differentiation could be important to achieve improved chondrogenesis in hMSCs. These findings can be used to improve the development of clinically translatable cartilage tissue constructs.
The First Annual Cleveland IDEAS Symposium: a comprehensive educational activity that encompasses a two day Basic Science workshop and a two day Clinical course covering current topics and cutting edge technologies in the field of gastrointestinal and liver diseases.

**Abstract**

The First Annual Cleveland IDEAS (International Digestive Education And Science) Symposium 2016 will be held Tuesday, September 6, 2016 – Saturday, September 10, 2016 in the Wolstein Research Building Auditorium. This CME-accredited program is being offered by The Case Digestive Health Research Institute to disseminate new knowledge from basic, translational, and clinical research/practice.

The Basic Science Track, Gastrointestinal Inflammatory Diseases: from Genetics to Novel Therapies, will kick off on the evening of Tuesday, September 6, 2016 with a keynote address on the gut microbiome by Eugene Chang, M.D., Martin Boyer Professor of Medicine at The University of Chicago. Basic science sessions on genetics, gut microbiome, barrier function, innate lymphoid cells, Th subsets and cytokines, and novel therapies will be presented by world renowned experts from the U.S. and abroad.

The Clinical Track, Transforming Digestive Health, will offer learning opportunities designed to help physicians enhance their competence, improve their performance, and improve the clinical outcomes of their patients in relation to gastrointestinal and liver diseases. New strategies, such as fecal microbiota transfer (FMT) and vibration controlled transient elastography (VCTE), will be described and discussion on implementation best practices.
Currently, very little is known about the role of social networks in shaping the food-related habits of people participating in the Supplemental Nutrition Assistance Program (SNAP). These social networks may serve as levers for interventions aimed at improving diet among this population. This study postulates that food habits are composed of three interrelated components including food procurement, preparation, and consumption habits. Thirty individuals participating in SNAP were interviewed about these three components. During the semi-structured interview, participants also were guided to create a social network map depicting the people and places involved in their food habits. The information gained from the interviews was then used to create three different maps of the people involved in the participants’ procurement, preparation, and consumption habits. These maps were created using UCINET software and NetDraw visualization tool for social network analysis. For each of the three components of people’s food habits total network size calculated and a density score was derived. The density score reflects which of the individuals specified in the food network know each other. A density score of one suggests everyone on the map knows each other. However, a brief analysis suggests a person’s social network density varies among the three components of their food habits. It is predicted that participants will be more social when eating food, compared to procurement and preparation activities, so the density will be higher.
Proteomic comparison of IFNg stimulated alveolar macrophages and blood monocytes

Lung macrophages are the first line of defense against Mycobacterium tuberculosis. To understand how lung macrophages develop and communicate we measured changes in lung macrophages and blood monocytes in response to a cytokine. These exploratory results will be used to study how these cells become activated to fight infection.

Background
During primary infection with Mycobacterium tuberculosis (MTB), lung alveolar macrophages (AM) and circulating monocytes (MN) respond to cytokine signals from other immune cells. Interferon-gamma (IFN-gamma) is known to be an important cytokine for control of MTB infection and disease. The effect of IFN-gamma on protein expression has been studied in MN and in monocyte-derived-macrophage cell culture models, but not in primary alveolar macrophages because these cells are more difficult to obtain. We sought to study the proteomes of monocytes and primary alveolar macrophages stimulated with IFN-gamma to compare effects in these two related cell types.

Methods
Ten human participants donated blood for MN isolation and bronchoalveolar lavage fluid for AM isolation. Cells were stimulated with IFN-gamma or media for 24 hours, lysed and digested with trypsin. Peptides were measured using liquid chromatography plus tandem mass spectroscopy (LC MS/MS) and identified using Mascot software. Peak heights were estimated using Progenesis software. The IFN-gamma effect was estimated as the difference between stimulated and unstimulated abundance for each protein within each subject.

Results
The total number of proteins detected in all cells and conditions was 2733 and 50% of those were detected in both AM and MN cells. A significant (p< 0.05) IFN-gamma effect was detected for 205 AM proteins and 222 MN proteins. The IFN-gamma inducible proteins that overlapped between AM and MN were enriched in an inflammatory disease network. Proteins that were differentially induced between AM and MN were more likely to be upregulated in MN and downregulated in AM. Differentially induced proteins were enriched in several pathways including the LXR/RXR lipid metabolism pathway, the Fc-gamma receptor-mediated phagocytosis pathway, and the EIF2 signaling pathway.

Conclusion
IFN-gamma 24 hour stimulation had a statistically significant effect on individual protein levels in AM and MN cells and these effects were different between these two related cell types. AM and MN specific pathways and networks that were significantly enriched suggest biological mechanisms related to cell signaling, differentiation and immune activation.
Increasing Healthcare Access for the Incarcerated in Fairbanks, Alaska

The Fairbanks North Star Borough is located in the heart of Alaska. Fairbanks is well known for its sense of community: residents here are independent yet take care of their own. Public health, with its duty to protect and serve the community, lies at the foundation. The general public largely disregards the concerns of the incarcerated and the need for transnational action to address the healthcare issues of this population as a priority. In response to this need, a quality improvement project began locally between the Fairbanks Regional Public Health Center and the Northstar Center, a resource that assists with the reintegration of inmates into society. Although there are many topics to address, the urgency to discuss sexually transmissible infections (STIs) quickly surfaced. Alaska and the Fairbanks Northstar Borough both boast increased STI rates and literature has pointed out that rates in the incarcerated are even higher. Collaboration between the two centers was well received and much appreciated; additional sessions to address other subjects are to follow.
**Title**: Role of the tumor suppressor p53 on human B-defensin-3 expression

**Abstract**

Objectives: Human β-defensin-3 (hBD3) functions as cytokine-like factor to recruit and activate tumor-associated macrophages for head and neck cancer (HNC) progression. Recent studies have revealed a causal link between chronic human papillomavirus (HPV) infection and a subset of head and neck squamous cell carcinomas, particularly tumors that arise largely from the lingual and palatine tonsils in the oropharynx. However, the production of hBD3 in HPV-associated HNC and the role of HPV oncoproteins in modulating hBD3 expression are still unknown.

Methods: Immunofluorescence microscopy was used to detect HPV16 E6, hBD3, and p63 proteins in HPV-positive cancer cells and HNC tissue samples. Quantitative RT-PCR and ELISA were used to detect hBD3 expression in cells. Binding site for p53 protein in the hBD3 gene promoter was identified using electrophoretic migration shift assays (EMSA) and chromatin immunoprecipitation (ChIP). Transcriptional activity of the hBD3 gene promoter was determined by dual-luciferase assays.

Results: Depletion of E6 by siRNA induces the tumor suppressor p53 and diminishes hBD3 in HPV16-positive CaSki cervical cancer cells. Malignant cells in HPV16-associated oropharyngeal cancer overexpress hBD3. HPV16 E6 induces hBD3 mRNA and peptide expression in mucosal keratinocytes transfected with an HPV16 E6 expression construct. Transactivation of the hBD3 gene promoter is stimulated by the E6 protein of HPV16, but not by that of low-risk HPVs. Inhibition of the tumor suppressor p53 stimulates hBD3 expression. However, activation of p53 by doxorubicin inhibits expression of hBD3 in primary oral keratinocytes and CaSki cells. A p53 binding site in the hBD3 gene promoter has been identified in keratinocytes using EMSA and ChIP assays. In addition, the p53 paralogue p63 protein isoform ?Np63?, but not TAp63, stimulates transactivation of the hBD3 gene.

Conclusions: Our study indicates that p53 acts as a transcriptional suppressor for hBD3 gene expression and supports hBD3 as a novel HPV regulated factor that facilitates HPV-associated tumor development and progression.
Nutritional profile of Labre free hot meal programs for the homeless in Cleveland

Since the homeless may solely rely on free meal programs, ensuring the nutritional quality of the meals these programs serve is vital especially since nutritional deficiencies can augment chronic diseases and poor quality of life. Improving the nutritional quality of meals for the homeless could contribute to a healthy diet.

Abstract

Since the homeless may solely rely on free meal programs, ensuring the nutritional quality of the meals these programs serve is vital especially since nutritional deficiencies can augment chronic diseases and poor quality of life. There are limited resources examining the nutritional quality of free hot meal programs for the homeless, especially those in Cleveland or those run by student groups. This project addresses these deficits in research. The sample size included three Labre homeless outreach programs based in Cleveland, Ohio: Case Western Reserve University, John Carroll University, and St. Ignatius High School. The duration of the study was eight weeks. Data was collected over the summer of 2015. Data for 24 meals was collected. During this study, the nutritional profile of food served by Labre free meal programs was quantitatively recorded from recipes, nutrition fact labels, and serving size, then input into Nutritionist Pro software. The data includes caloric content, food groups, macro- and micronutrients. The 24 meals were averaged for each nutrient value. The nutrients of an average meal are compared to the Dietary Reference Intakes (DRIs), including the Recommended Dietary Allowance (RDA), Adequate Intake (AI), and Acceptable Macronutrient Distribution Range (AMDR). The Dietary Guidelines for Americans (DGA) were also used for comparison. It was found that on average, the free meals were low in fiber, biotin, folate, pantothenic acid, riboflavin, vitamin A, vitamin B6, vitamin B12, vitamin C, vitamin D, vitamin E, vitamin K, potassium, calcium, chromium, copper, fluoride, magnesium, manganese, molybdenum, zinc, vegetables, fruit, and dairy; were high in carbohydrate, fat, protein, thiamin, sodium, iron, selenium, calories, empty calories, saturated fat, grains, and protein foods. Improving the nutritional quality of free meals for the homeless could contribute to a healthy diet, which has many benefits.
The trouble with increasingly complex molecular building blocks is that they require increasingly complex strategies to functionalize them. One strategy, about forty years old, is remote functionalization. A particularly promising approach is to attach an arm to a site which can then functionalize another atom within its reach. Our approach uses the xanthene attached to a metalloporphyrin with two components: iodosylbenzene and a xanthyl derivative bearing a methyl carboxylate. The four nitrogen molecules at the center of the porphyrin have been used as a metal atom complexer in this case, iron. This system inspired by the chlorophyll and hemoglobin structure has been used as an enzyme mimic but also more generally. The usefulness of the target structure would have many applications such as stereospecific catalysis.

Two main breakthroughs are possible if the target structure is achieved. First the use of this complex to isolate and possibly discover new hypervalent iodine compounds and second the ability to use this as a superior catalytic path. If the latter breakthrough is true then this complex could replace standard organic reagents previously thought to be the most efficient means.

The trouble with increasingly complex molecular building blocks is that they require increasingly complex strategies to functionalize them. One strategy, about forty years old, is remote functionalization. A particularly promising approach is to attach an arm to a site which can then functionalize another atom within its reach. Our approach uses the xanthene attached to a metalloporphyrin with two components: iodosylbenzene and a xanthyl derivative bearing a methyl carboxylate. The four nitrogen molecules at the center of the porphyrin have been used as a metal atom complexer in this case, iron. This system inspired by the chlorophyll and hemoglobin structure has been used as an enzyme mimic but also more generally. The usefulness of the target structure would have many applications such as stereospecific catalysis.
Introduction Currently, the highest reported oral complication in HIV/AIDS is traditionally-defined periodontal diseases (PD). Polymorphisms in toll-like receptor (TLR) and human β-defensin (hBD, encoded by DEFB) genes have been recognized as potential genetic factors that can influence susceptibility to and severity of PD. However, the data regarding associations between these gene variations and PD are still scarce in North American populations, and are not available in North American HIV+ populations. Methods We analyzed samples from HIV+ subjects (n = 115), who received primary HIV care at 3 outpatient HIV clinics in Cleveland, OH, between May 2005 and March 2009. We genotyped a total of 41 SNPs in 8 TLR genes (TLR1, 2, 3, 4, 6, 7, 8 and 9) and DEFB4/103A CNV. We performed association analyses for 3 microbial measures (P. gingivalis [Pg], T. denticola [Td], T. forsythia [Tf]) and 3 periodontal measures (periodontal probing depth [PPD], gingival recession [REC], bleeding on probing [BOP]). Results 1. Using all subjects, 2 SNPs in TLR1 were significantly associated with Td, and one SNP in TLR2 was significantly associated with BOP. One of the 2 SNPs in TLR1 was significantly associated with Td in Caucasians. In addition, another SNP in TLR1 and a SNP in TLR6 were also significantly associated with Td and Pg, respectively, in Caucasians. 2. All 3 microbial measures were significantly associated with PPD and BOP, but none of them was associated with REC. 3. Instrumental variable analysis showed that a total of 8 SNPs in 6 TLR genes were significantly associated with the 3 microbial measures. However, taking the effect of these SNPs into account, none of the microbial measures was associated with PPD or BOP. 4. No association was found between DEFB4/103A CNV and any of the microbial or periodontal measures in all samples, Caucasians, and African Americans. Conclusion In this HIV+ cohort, TLR SNPs were associated with both microbial and periodontal measures of PD.
The manipulation/patterning of microparticles (from inorganic microbeads to living cells) on surfaces has gained increasing interest in recent years due to many potential applications in biosensor technology and tissue engineering. Researchers have developed techniques, e.g., soft lithography[1], dip-pen nanolithography (DPN)[2], optical tweezers[3] and surface acoustic wave (SAW) devices[4]. However, soft lithography and DPN require initial chemical coatings. Optical tweezers usually manipulate microparticles one by one and thus are time-consuming and may damage the cells. SAW devices can manipulate microparticles speedily but mostly into dots and lines and the device structures are less easy-to-fabricate.

In our work, we focus on microparticle patterning, especially breast cancer cells, by using multimode Si3N4 membrane resonators. We fabricate silicon nitride (Si3N4) membrane devices (hundreds of micrometers in dimensions) which demonstrate multiple flexural modes (50-500kHz) under piezoelectric excitation in liquid. Our first tests with silica (SiO2) microbeads (3.62µm) show at least ten Chladni figures[5] formed within seconds individually. We also demonstrate that this technique is applicable to breast cancer cells (MDA-MB-231) through observing patterns and frequencies that match with the microbead experiments. We further show that patterns can transition dynamically by solely varying the piezoelectric actuator frequency. We successfully match the microparticle patterns with mode shapes obtained from a finite element simulation.

Such membrane resonators provide great potential to dynamically manipulate/pattern microparticles at a fast speed, with microscale precision, which may lead to applications in the biomedical, biological, and clinical fields.

**Title**: Early Events in the Absorption of Ultraviolet Light by Pterin Biomolecules

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**Presented by**: Regina DiScipio

**Elevator Speech**: Pterins exist naturally in human bodies; they can absorb high energy UV light. This means that the pterins are capable of generating certain cancers. To assess this risk, we’re presenting how the pterins use and transfer energy to understand interactions with DNA which may lead to cancer.

**Abstract**: Pterins are a naturally occurring class of heterocyclic organic compounds found naturally in human bodies. Recent evidence suggests that pterin derivatives can damage DNA and other biomolecules in skin cells when exposed to ultraviolet (UV) radiation. Indeed, pterins are known to strongly absorb UV light in the UVA and UVB regions (290 to 400 nm) of the solar spectrum, leading to the population of long-lived reactive states and the generation of reactive oxygen species. These characteristics are analogous to those of photosensitizing compounds used in photodynamic therapy to kill cells. Our group is interested in delineating the electronic relaxation pathways leading to the postulated photoreactivity of these compounds in an effort to better understand this chemistry. In particular, I will present recently acquired results from time-resolved absorption spectroscopy, which has allowed us to characterize the transient species and associated decay lifetimes of three pterin compounds (pterin, bioppterin and neoppterin) following electronic excitation at 350 nm. The experimental results are further complemented with density functional calculations, which allow us to propose electronic relaxation mechanisms that can satisfactorily explain the reported photoreactivity of these compounds in solution. The potential implications of our results in the exposure of cells to UVA and UVB light will be briefly discussed.

The authors acknowledge the CAREER program of the National Science Foundation (Grant No. CHE-1255084) for financial support.
**Title**

Triterpenoid (CDDO-DFPA) ameliorates neuroinflammation during autoimmune encephalomyelitis by modulating NF-kB signaling in dendritic cells

**Abstract**

Multiple sclerosis (MS) is the most common chronic demyelinating disorder of the CNS, affecting more than 2.3 million people worldwide. Development and progression of MS completely initiate from the dynamic nature of immune cells, particularly their ability to interact with dendritic cells (DCs) to rapidly be activated and migrate to the CNS. Multiple therapeutics have shown limited efficacy to completely prevent or cure the disease due to complexity of the disease as well as their inability to effectively manage inflammatory process. Triterpenoids as multifunctional small molecules, regulate inflammatory and the redox states of cells by modulating Nrf2 and NF-kB mediated transcriptome. Here we report for the first time the use of a new class of synthetic triterpenoids, 2-cyano-3,12-dioxooleana-1,9(11)-dien-28-oic acid-difluoropropylamide (CDDO-DFPA) in treatment of murine model of MS, experimental autoimmune encephalomyelitis (EAE). Our data reveal that a short exposure to CDDO-DFPA treatment not only suppresses the clinical and pathological symptoms of EAE by reducing inflammation and maintaining myelin integrity but also increases the survival of these mice. Interestingly, CDDO-DFPA treatment modulated the NF-kB-mediated inflammatory (TNFa, IL-1, IL-6, IL-23, COX2, and NOS2), anti-inflammatory and anti-oxidant (TGFb, IL4, IL-10, SOCS1, SOCS2, and HMOX1) cytokine and protein signature in DCs without altering the surface ligand expression and the antigen uptake ability of these cells. This altered cytokine profile, however, affected peripheral T cell differentiation and resulted in significantly reduced Th1 and Th17 T cells with increased immunosuppressive Th2 and Treg subset. Lastly, CDDO-DFPA suppressed DC-induced T cell proliferation both in allogeneic and syngeneic models. In conclusion, these findings demonstrate the potential therapeutic utility of CDDO-DFPA in the treatment and prevention of the neuroinflammatory and autoimmune disorders such as MS.
Consolidation of wakefulness and sleep into discrete time periods requires tightly controlled activity levels between subcortical and cortical brain regions. Efficiency of neuronal communication between those brain regions occurs through subcortical and cortical networks. In this study, we sought to determine if neuronal activity within those discrete cortical networks can be non-invasively measured in healthy human participants and whether differences in synaptic conductivity emerge during wakefulness and sleep. Cortical network dynamics are theorized to be sensitive to irregular changes of synaptic messages or synaptic noise. We employed high-density electroencephalography (HD-EEG) to measure and record cortical network activity. Attached to a fabric cap worn over the scalp, the HD-EEG system consists of 128 electrodes that record cortical electrical activity up to a frequency of 10,000 Hertz (Hz). Healthy human volunteers were asked to maintain a quiet but vigilant state of wakefulness (n=5) or to close their eyes and fall asleep (n=2). Cortical network activity was measured and recorded for 20 minutes to 8 hours. All 128 channels of recorded HD-EEG underwent principal component analysis to quantify EEG frequencies and amplitudes throughout cortical networks. Distinct patterns of HD-EEG emerged within specific cortical areas and networks distinguishing wakefulness from sleep. Frequencies that dominated most cortical networks during wakefulness included theta (4-8 Hz) and alpha (8-13 Hz). Delta activity (0.1- 4 Hz) predominated in most cortical networks during sleep. During quiet wakefulness, alpha activity was predominant in the posterior cortical network with an area of concentration within the central occipital and right temporal areas. HD-EEG provided high levels of temporal and spatial resolution to enable identification of distinct patterns of cortical network activities within discrete brain regions. Those patterns heralded the onset of wakefulness and sleep prior to the outward signs of those states. We may now be able to distinguish levels of vigilance, during wakefulness, within specific brain regions. This would facilitate detection of impairment within well-defined neural networks leading to symptoms of reduced alertness or cognitive dysfunction, such as an inability to concentrate or maintain focus.
Wound healing is a critical step in reestablishing homeostasis in the oral mucosa; it reduces microbial invasion and prevents chronic infection. While CD98 has been reported to be important for wound healing, little is known about its activity in the oral cavity. Recently, CD98 was identified as a receptor for human beta defensin 3 (hBD-3), an epithelial-derived antimicrobial and immunoregulatory peptide.

Objective: To study the interactions of the hBD-3/CD98 axis in human oral epithelial cells (HOECs) for receptor internalization and cell migration.

Methods: For internalization studies, HOECs were treated with hBD-3, followed by fluorescence microscopy and flow cytometry to determine CD98 surface levels of expression. Westerns were also used to assess intracellular levels of CD98. To study cell migration, we used a wound healing assay, where HOECs were seeded in a 96-well ImageLock microplate from ESSEN BIOSCIENCE. After ~90% confluence, monolayers were treated with hBD-3 for 24h and then scratched using a robotic wound maker. Wound closure was monitored by IncuCyte Zoom from the same manufacturer.

Results: HBD3 resulted in surface and intracellular reduction of CD98 in HOECs, as well as inhibition of cellular migration. Conclusion: Our data suggests that hBD-3 inhibits cell migration by reducing CD98 surface expression and possibly promoting receptor ubiquitination in HOECs. HBD-3 interaction with CD98 requires further investigation to determine its biological relevance in vivo. Supported by NIDCR: P01 DE019759.
The Clinical and Translational Science Collaborative of Cleveland provides developmental, organizational, financial, and educational support to biomedical researchers as well as opportunities for community members to participate in meaningful and valuable research.

The goal of the CTSC is to provide full service and integrated clinical translational research capability within the Cleveland community that will improve the health of patients in Northeast Ohio through patient-based research. The CTSC also provides career development support for clinical investigators and offers research participant resources in support of technology-intensive studies.

The CTSC coordinates resources relevant to clinical research at Case Western Reserve University and its hospital affiliates, Cleveland Clinic, MetroHealth Medical Center, University Hospitals Case Medical Center, and the Louis Stokes Cleveland Veterans Medical Center including a successful multidisciplinary institutional KL2 program, substantial technological and statistical core facilities, and a M.D-Ph.D. program in clinical research. The infrastructure support provided will impact everyone who conducts clinical research in the partner institutions and community.

CTSC resources are easily accessed online and/or in person through the Office of the Research Concierge Service, and assure prospective input into proposals by statistics and design experts, ethicists and regulatory experts, and any other expertise that the project requires including research participant resources.
Cholesterol in mouse retina originates primarily from in situ de novo biosynthesis

Elevator Speech
Age-related macular degeneration (AMD) is the leading cause of blindness in the elderly and its hallmark clinical symptom involves cholesterol-rich lesions in the retina. We identified that the majority of retinal cholesterol is synthesized locally, which suggests that statins, which inhibit cholesterol biosynthesis, can potentially be used for AMD treatment.

Key Words
- age-related macular degeneration
- isotopic tracer
- dietary cholesterol

Abstract
The retina, a thin tissue in the back of the eye, has two apparent sources of cholesterol: in situ biosynthesis and cholesterol available from the systemic circulation. The quantitative contributions of these two cholesterol sources to the retinal cholesterol pool is unknown and have been determined in the present work. A new methodology was used. Mice were given separately deuterium-labeled drinking water and chow containing 0.3% deuterium-labeled cholesterol. In the retina, the rate of total cholesterol input was 21 micrograms of cholesterol/g retina · day, of which 15 micrograms of cholesterol/g retina · day were provided by local biosynthesis and 6 micrograms of cholesterol/g retina · day were uptaken from the systemic circulation. Thus, local cholesterol biosynthesis accounts for the majority (72%) of retinal cholesterol input. We also quantified cholesterol input to mouse brain, the organ sharing important similarities with the retina. The rate of total cerebral cholesterol input was 121 micrograms of cholesterol/g brain · day with local biosynthesis providing 97% of total cholesterol input. Our work addresses a long-standing question in eye research and adds new knowledge to the potential use of statins (drugs that inhibit cholesterol biosynthesis) as therapeutics for age-related macular degeneration, a common blinding disease.
Glioblastoma multiforme (GBM) are the most common primary malignant brain tumor in adults, with a median survival of about one year. This poor prognosis is attributed primarily to therapeutic resistance and tumor recurrence after surgical removal, with the root cause suggested to be found in glioblastoma stem cells (GSCs). Using glial fibrillary acidic protein (GFAP) as a reporter of astrocytic differentiation, we isolated multiple clones from three independent GSC lines which express GFAP in a remarkably stable fashion. We next show that elevated expression of GFAP is associated with reduced clonogenicity in vitro and tumorigenicity in vivo. Utilizing this in vitro cell-based differentiation reporter system we screened chemical libraries and identified the non-depolarizing neuromuscular blocker (NNMB), Atracurium Besylate, as a small molecule which effectively induces astroglial but not neuronal differentiation of GSCs. Functionally, Atracurium Besylate treatment significantly inhibited the clonogenic capacity of several independent patient-derived GSC neurosphere lines, a phenomenon which was largely irreversible. A second NNMB, Vecuronium, also induced GSC astrocytic differentiation while Dimethylphenylpiperazinium (DMPP), a nicotinic acetylcholine receptor (nAChR) agonist, significantly blocked Atracurium Besylate pro-differentiation activity.

To investigate the clinical importance of nAChRs in gliomas, we examined clinical outcomes and found that glioma patients with tumors overexpressing CHRNA1 or CHRNA9 (encoding for the AChR-?1 or AChR-?9) exhibit significant shorter overall survival. Finally, we found that ex-vivo pre-treatment of GSCs, expressing CHRNA1 and CHRNA9, with Atracurium Besylate significantly increased the survival of mice xenotransplanted with these cells, therefore suggesting that tumor initiating subpopulations have been reduced.

Our study uncovers a novel link between AChR and the regulation of astroglial differentiation in GSCs. Enforced cancer stem cell differentiation aiming at decreasing brain tumor-initiating ability through acetylcholine receptor modulation may lead, in the future, to the development of new therapeutic strategies for GBM.
p53, a stress response gene, is involved in diverse cell death pathways and its activation has been implicated in the pathogenesis of Parkinson’s disease (PD). However, whether the neuronal p53 protein plays a direct role in regulating dopaminergic neuronal cell death is unknown. In this study, in contrast to the global inhibition of p53 function by pharmacological inhibitors and in traditional p53 knock-out (KO) mice, we generated a p53 KO mouse line utilizing DAT-IREScre knock-in mice, in which p53 was selectively deleted in DA neurons of the nigrostriatal system (DAT-p53KO). These DAT-p53KO mice did not exhibit apparent changes in the general structure and neuronal density of DA neurons during late development and in aging. There were no significant changes in body weight and viability in these DA-p53KO mice, when compared to wildtype (WT) mice. However, in DA-p53KO mice treated with the neurotoxin MPTP (1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine), we found that selective deletion of p53 in DA neurons inhibited p53 downstream pro-apoptotic genes; the induction of
### Abstract

Polymer aerogels with high surface areas and low densities have numerous applications, including insulation, low dielectric substrates and catalyst supports. Organic polymers can suffer from high flammability, which limits their use. A hybrid of polymeric aerogel and inorganic nanoparticles was produced by ice-templating of a polymer solution, followed by a sol-gel process which infiltrated the structure with silica. Compared to the pristine polymer aerogel, the composite aerogel exhibited excellent fire resistance and superior mechanical properties. By controlling the sol-gel process conditions, different morphologies could be achieved, further modifying flammability properties of the composite.

### Elevator Speech

This study will pave the road for producing a variety of nanocomposite aerogels, leading to practical applications such as fire resistance, filtering, and substrate-assisted catalysis.
Bromodomain and Extra Terminal (BET) proteins are epigenetic “readers” that recognize acetylated histones and mark areas of the genome for transcription. BRD4, a BET family member protein, has been implicated in a number of types of cancer. It has been recently found to associate with super-enhancers, and elevated levels of BRD4 have been linked to increased expression of MYC as well as other oncogenes. BET inhibitors are currently being tested for their potential use in the treatment of HIV, heart failure, and cancer, all of which are diseases of aberrant transcription. However, little is known regarding their efficacy in triple-negative breast cancer (TNBC). We found JQ1, a prototypical BET inhibitor, impedes growth of seven TNBC cell lines in a dose-dependent manner within 72 hours of treatment. JQ1 also suppresses growth of three different TNBC xenografts, including a patient-derived model of basal-like breast cancer. Growth arrest, in vitro, is followed by either apoptosis or senescence. However, prior to the induction of these two terminal responses, prolonged treatment results in polyploidy in many of the cell lines, suggesting BETi disrupt mitosis/cytokinesis. Live-cell imaging revealed JQ1 significantly increased the duration of mitosis, and microarray analyses showed a significant JQ1-mediated downregulation of genes critical for cell cycle progression, mitosis, and cytokinesis. In all TNBC cell lines tested, Aurora kinases, proteins critical for proper progression through mitosis and cytokinesis, are suppressed in response to JQ1. Treatment with AZD1152, an Aurora kinase B inhibitor, elicits the same cellular responses as BET inhibition, indicating that the suppression of Aurora kinases plays a key role in the response of TNBC cells to BET inhibitors. These findings reveal that BET inhibitors block the growth of highly aggressive TNBC cells by inducing mitotic dysfunction and that these drugs are promising potential therapeutics for the treatment of TNBC.
Abstract

In psychology, working memory is defined as a cognitive function describing the human capacity to absorb, retain, and manipulate information from the environment (Baddeley, 1992). Working memory is also believed to have implications in processes such as decision making and behavior, as well as intelligence (Conway, Macnamara, & Engel, 2011). However, many questions surround working memory and the nature of its construction. Currently, it is believed that working memory involves only one single underlying process used across all situations (D’Esposito & Postle, 2015). However, researchers have recently begun to theorize that working memory is actually a set of multiple different task-specific processes (D’Esposito & Postle, 2015). In this study, the question of working memory as a single or multiple different processes will be studied using a set of 9 computerized working memory tasks divided into three different categories: maintenance and interference, maintenance and manipulation, and updating. The 9 computerized working memory tasks administered in this experiment include: N-back verbal, N-back spatial, numerical updating, alphabetical span, spatial span, let-number sequencing, as well as operation, reading, and symmetry span tasks. Should working memory be considered a single process, it is expected that performance should be consistent across all tasks. However, it is expected that performance will vary between tasks of different categories, suggesting that working memory is a set of different processes. The validity and reliability of these 9 tests will be examined in this study. Before variability in performance can be meaningfully studied, the reliability of each test must be established.
An estimated 600,000 children die of malaria annually, with most of these deaths occurring in African children under the age of five. The pathogenesis of malaria caused by Plasmodium falciparum (Pf), the most deadly of the malaria species in humans, is not fully understood. This is largely due to the fact that it takes years of repeated exposure to Pf before immunity to clinical manifestations of infection develop, implying that B cell memory is impaired and incomplete up until that point. The first phase of my project uses a multiplex bead assay to analyze IgG antibodies in Kenyan residents from a time of high Pf transmission (2003) compared with a time of low Pf transmission (2013). We measured antibodies to 34 malarial proteins classified by when they are expressed during the parasite lifecycle (i.e. pre-erythrocytic stages (sporozoites and liver development), merozoite invasion of erythrocytes, expression on the surface of infected erythrocytes). Examples from these three categories include, respectively, Circumsporozoite Protein (CSP), a current vaccine candidate being tested in Africa, Merozoite Surface Proteins (MSP) 1 and 6, and Pf Erythrocyte Membrane Protein 1 (PfEMP1) domains DBLa2 and CIDRa1.4. We have found that antibodies to several of these proteins increase with age and are boosted by current Pf infection. Additionally, adults and children from 2003 had much higher breadths and magnitudes of responses compared with those in 2013, supporting the hypothesis that boosting is important to maintain Pf-specific antibodies. Further studies will involve evaluation of memory B cell phenotypes and functional responses to a subset of these malarial proteins.
A Bio-Inspired High Efficiency Wind Turbine Blade Prototype

Wind tunnel tests of model humpback whale flippers with and without leading-edge tubercles have demonstrated that tubercles significantly improved its fluid dynamics with a staggering 32% reduction in drag and 8% improvement in lift. Inspired by this discovery, we would like to build an innovative wind turbine blades with leading-edge tubercles emulating those in humpback whale flippers. To accomplish this goal, the fabrication process of the smart blade will be assisted with the use of advanced computational simulations to optimize its design. The performance of the bio-inspired smart blade will be evaluated by CFD simulation, particularly the benefits of tubercles in modulating the lift and drag coefficients of the smart blades to achieve higher efficiency and resiliency. This research will also test the effects of different types of airfoil as well as different chord lengths of an airfoil cross section. The goal of this research aims to come up with prototype bio-inspired smart blade technology that potentially significantly improve the efficiency of wind energy production.
Abstract
Suction caisson foundation are widely used in offshore foundation systems, and the application is being extended to offshore wind industry gradually. The offshore wind turbines are mainly subjected to lateral loads induced by wind, wave and ice. Centrifuge tests were performed to study the response of wind turbine with suction caisson foundation under one-way force-controlled static and cyclic lateral loads. The accumulated lateral displacements and settlements were recorded by LVDTs. The lateral capacity and stiffness of the suction caisson foundation are investigated. The results provide a reference to further research and optimization design on offshore suction caisson foundation in service.
Superparamagnetic iron oxide nanoparticles are widely researched due to their biocompatibility and potential applications as diagnostic and therapeutic agents. Iron oxide exists in several crystal phases with the most important being the highly magnetic magnetite phase. Magnetite (Fe₃O₄) nanoparticles are typically synthesized via the direct oxidation of the as-prepared paramagnetic wüstite (FeO) nanoparticle phase. In this study, we evaluated the use of an inverted linear Halbach array to separate monodisperse FeO and Fe₃O₄ nanoparticles, which were then characterized using vibrating sample magnetometry (VSM), atomic absorption spectroscopy (AAS), and powder x-ray diffractometry (XRD) methods to provide a semi-quantitative analysis of the iron oxide phase composition. Hydrophobic monodisperse FeO nanoparticles were prepared via a thermal decomposition approach and subsequently oxidized to Fe₃O₄ using trimethylamine N-oxide. The as-synthesized FeO and Fe₃O₄ nanoparticles are coated with organic surfactants and to make them water soluble we adopted two different solubilization methods: (1) a ligand exchange process, and (2) an encapsulation method. Comparison of the effects of these two solubilization methods on the oxidation stability of the iron oxide nanoparticles was also investigated.
Caregivers of advanced cancer patients are an integral part of the end-of-life treatment process. They fulfill the traditional caregiver role and collaborate with the patient and cancer care team in making treatment decisions, all while facing the potential loss of their loved one. In spite of their key role, few studies have examined cancer care at the end-of-life from the caregiver’s perspective. The purpose of this study is to explore advanced cancer patients’ caregivers’ satisfaction with care received just prior to death. The present study includes 18 caregivers of patients with advanced cancer. Both patients and caregivers participated in an ongoing parent study that is examining the factors associated with cancer treatment decision-making at the end-of-life. Approximately 2 months after the patients passed away, the caregivers were interviewed to determine their satisfaction with the care the patients received just prior to death. They also provided other information pertaining to the death of their loved one, such as place of death, enrollment in hospice, alignment of care with the patient’s wishes, etc. Using thematic analysis, the interviews were examined in order to better understand the caregivers’ experiences and to highlight their unique perspectives. Additional data for this study include: a comparison of the circumstances from two caregivers – one satisfied and one dissatisfied with the patient’s care just prior to death, patient and caregiver demographics, and preliminary aggressiveness of care data, including hospice enrollment, chemotherapy use, and hospital admissions in the last month of life. Each caregiver experiences the death of a loved one in a profound and individual way. Their stories provide valuable insights that add to the body of knowledge about advanced cancer treatment decisions. With these insights, interventions can be developed to improve the care experience for patients and their loved ones during the last weeks of life.
Abstract

Restorative therapies, particularly for restoring motor or sensory function, may utilize neural interface technology as an approach to treatment. These systems may incorporate fine wires, cables or coils that transmit recording or stimulation signals depending on the flow of information. Design and validation of these systems require an understanding of the factors governing fracture and fatigue behavior.

This poster reviews the current literature by surveying sources on wire fatigue relevant to biomedical applications. Several common material systems are covered and range from single wire to multi-filar coil architectures and capture a variety of test methodologies and conditions.

The published effects of changes in cable/coil architecture, material cleanliness, and test conditions on fracture and fatigue behavior of these systems are presented. The data encompasses information that can be applied to medical devices that utilize wires/cables/coils and points to opportunities for future work.
The feasible geothermal heat exchanger pile based snow melting system is an innovative snow melting technique, which adopts geothermal as a heat source to melt snow accumulated on the pavement surface. The presence of this technique conquers the issue of road corrosion as well as negative environmental effects caused by mechanical and/or chemical snow melting approaches, moreover, it performs advantage of cost-effective compared with conventional geothermal snow melting system. However, the application of geothermal heat exchanger pile based snow melting is still hindered by locations as well as limited total pile length. In this paper, a 3D numerical model is proposed to predict the energy extraction rate for the considered pile, based on which, sensitivity analyses on the influence of geothermal heat exchanger pipe arrangement type (U-shape, W-shape and spiral shape) and velocity of circulated fluid are conducted. In order to demonstrate the feasibility of geothermal heat exchanger pile based snow melting system in United States, a hypothetical bridge deck (200m length by 14.8m (4 lanes) width) is assumed to utilize this system in 10 different cities, which have typical snowfall and ground temperature conditions. The results show that the pipe arranged in spiral shape performs great advantage in energy extraction, it, therefore, should be the first option for geothermal snow melting system design. In addition, the geothermal heat exchanger pile based snow melting system with spiral arranged pipe is only applicable for a) most cities at design condition of Ar=0; b) cities located in region III and IV at design condition of Ar=0.5; c) cities with similar heating demands for different Ar values.
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. Typically, to determine effectiveness of NIBS, a sham-control is included for comparison. However, the use of sham NIBS as a true placebo has been questioned because patients may not be adequately blinded and sham stimulation can still deliver minimal amounts of stimulation (Davis et al. 2013). Here, we tested whether sham stimulation affects neurophysiology in chronic stroke patients. Thirteen chronic stroke patients underwent one session of sham NIBS and another session where they received no form of stimulation. Before and after each session, we used transcranial magnetic stimulation (TMS) to assess corticospinal physiology as recruitment of corticospinal pathways and their inhibition from opposite motor cortices. Effectiveness of sham was confirmed by asking patients whether they believed they were receiving active or sham stimulation. We computed pre to post change for corticospinal recruitment and interhemispheric inhibition. We found that the pre to post change in absolute terms for sham NIBS was significantly larger for the corticospinal recruitment of the unaffected hemisphere (Z = -2.4, p = .015) and interhemispheric inhibition upon the affected (Z = -2.9, p = .004) and the unaffected hemisphere (Z = 2.9, p = .028), when compared to no stimulation. Overall, the absolute differences shows sham NIBS results in greater variability of corticospinal recruitment and interhemispheric inhibition. Our results suggest sham stimulation may not be an adequate control for basic metrics of corticospinal physiology. The variability of TMS following sham stimulation also may be due to the minimal amount of stimulation from the sham. Future studies should exercise caution when interpreting results from sham-controlled clinical trials.
Among the 7+ billion persons in the world, praying to God is a very prevalent activity that enhances a person’s life in many ways. The frequency of prayer may be a good indicator of the value of religion. To estimate the frequency of daily prayers by all persons on the planet, I started out studying the adherents of the four major religions. The largest is Christianity (2.2 billion) the next is Muslin (1.6 billion) followed by Hindu (1 billion) and then Buddha (400 million). Other smaller religions have about 500 million adherents. Persons with no religion amounts to about 20% of the total population. Some of these people pray but not as they would if they believed in a particular religion.

The basic assumptions underlying this study are: 1. Persons under ten years of age were considered to not pray. 2. Surveys of frequency of prayer differed considerably and what seemed most reliable were used. 3. The frequency of prayer in persons who are not adherents to a particular religion required many assumptions and resulted in a very rough estimate.

This research is a work in progress and the details of deriving the estimates is too extensive for this abstract. My first estimates indicate that Christians say about 2.2 billion prayers a day. Muslims say about 4 billion prayers a day. It is widely known that many male Muslims pray five times a day. If they started praying at ten years of age and then live to 80 years, they will have said about 135,000 prayers in their lifetime. This is about the same for orthodox Jews. This statistic will be pursued for the other religions.

At this time I estimate that among the 7+ billion people, the number of prayers said every day is about eight billion, plus or minus one billion.

A friend who asked me about my research, and I mentioned this study, has reported back to me that my preliminary findings have changed and improved her view of God. Thus it is possible that this study (even though N=1) may effect a desirable behavior change that may be helpful to those who pray.
Betaine Supplementation Reduces Congenital Defects Induced by Prenatal Alcohol Exposure

Abstract

Over 500,000 women per year in the United States drink during pregnancy, and 1 in 5 of this population also binge drink. As high as 40% of live-born children with prenatal alcohol exposure (PAE) present with congenital heart defects including outflow and valvuloseptal anomalies that can be life-threatening. Previously we established a model of PAE (modeling a single binge drinking episode) in the avian embryo and used optical coherence tomography (OCT) imaging to assay early-stage cardiac function and structure and late-stage cardiac defects. At early stages, ethanol-exposed embryos had smaller cardiac cushions and increased retrograde flow. At late stages, they presented with gross defects in the head and chest wall, and also exhibited smaller or abnormal atrio-ventricular (AV) valves, thinner interventricular septae (IVS), and smaller vessel diameters for the aortic trunk branches. In other animal models, the methyl donor betaine (found naturally in many foods such as wheat bran, quinoa, beets and spinach) has ameliorated neurobehavioral deficits associated with PAE but the effects on heart structure are unknown. In our model of PAE, betaine supplementation led to a reduction in gross structural defects and prevented certain types of cardiac defects such as ventricular septal defects and abnormal AV valves. Furthermore, great vessel diameters, IVS thicknesses and mural AV leaflet volumes were normalized while the septal AV leaflet volume was increased. Finally, analysis of DNA methylation was performed within 24 hours of injection by immunofluorescent staining for 5-methylcytosine in transverse embryo sections at the level of the cardiac neural crest. DNA methylation levels were reduced by ethanol exposure and normalized by co-administration of betaine. These findings therefore highlight the potential for betaine, a methyl donor, to be used in the prevention of PAE-related birth defects.
Clozapine remains the gold standard medication for treatment resistant schizophrenia. However, due to side effects, namely, agranulocytosis, the use of clozapine is limited. The current treatment guidelines require that patients, prescribers, and pharmacists utilize a clozapine registry which includes a surveillance protocol for side effect monitoring.

While the intent of the system is to ensure that the risks of these potentially life-threatening side effects are mitigated, is not a one-size-fits-all solution. Patients with baseline low neutrophil counts such as those with Benign Ethnic Neutropenia (BEN) may not be able to initiate or continue treatment with clozapine if their lab values fall below pre-defined guidelines based on a normative sample, even if the patient is asymptomatic.

The FDA recently approved a new monitoring system, Clozapine REMS (Risk Evaluation and Mitigation Strategy) to replace the six existing clozapine registries that maintained by individual drug companies. Additionally this new system calls for less stringent monitoring guidelines for patients with BEN.

We describe a case of a 12 year old male with treatment resistant schizophrenia and comorbid benign ethnic neutropenia. In collaboration with the pediatric inpatient hematology / oncology consultation team, the inpatient pharmacy, his outpatient treatment team, and his guardian, we implemented a modified surveillance protocol that takes into consideration benign ethnic neutropenia. This is a remarkable approach as there are no treatment guidelines in the United States for using Clozapine patients with BEN, and to the best of our knowledge, there is no existing data on the treatment of patients as young as this boy who have treatment resistant schizophrenia and comorbid BEN. We also discuss how the implications of the new Clozapine REMS system would have impacted this child's care.
**Abstract**

This study presents a novel MRI-actuated steerable robotic catheter system. The catheter is embedded with an array of current-carrying micro-coils, which includes one (or more) axial coil, and two (or more) orthogonal side coils. The catheter is then actuated by the magnetic forces generated by the magnetic field of the MRI scanner on these coils, by controlling the amount of current going through the coils. The advantage of this actuation is its dexterousness, as the actuator is near the catheter tip. The research study focuses on 1) development of new models and algorithms for robotic motion planning and control of a MRI-actuated steerable robotic ablation catheter system, and, 2) hardware realization and experimental validation of the developed technologies.
**Title**

*Charge-discharge characteristics of redox copolymers and composites containing TEMPO and charge-neutralizing anion*

**Abstract**

A copolymer and a composite containing redox-active robust radical, 2,2,6,6-tetramethyl-piperidine-1-oxyl (TEMPO), and charge-neutralizing anion, trifluoromethanesulfonyl imide (TFSI), were investigated as cathode-active materials toward an organic rechargeable battery with high energy density. The copolymer was synthesized by the copolymerization of TEMPO-substituted methacrylate and TFSI-substituted styrene with controlled composition. The copolymer and composite exhibited reversible redox response accompanied by charge compensation with the anionic groups bound to a polymer chain, which allows electrolyte concentration to be constant during charge-discharge process. The so-called rocking chair type charge-discharge downsizes the overall battery and maximizes the volumetric energy density as a result of reduction of electrolyte volume. The charge-discharge behavior was confirmed by the redox potential shift with respect to electrolyte concentration and combined mass-transfer analysis with electrochemical measurement. We also investigated that close TEMPO and TFSI units in the copolymer promoted charge-neutralization by the TFSI and consequently the rocking chair type charge-discharge.
Empathy in the human-centered product design process

Empathy is central to human-centered design techniques, but it has received little attention in design process research. Instead, studies have focused on strategies, heuristics, biases, mental representation, and expertise. However, when empathizing, people differ in how much they feel the emotions and comprehend the thoughts of the other person. Because empathy has been shown to vary based on properties of narrative, perception of individuals and groups, and other contextual information, it is hypothesized that increased cognitive empathy leads to different design outcomes compared to emotional empathy. This study looks at how the presentation of user information, either persona or survey summary, affects how designers use empathy to develop products. Personae and survey summaries are typical tools in human-centered design processes, but whereas personae depict a prototypical character usually within the context of some narrative, survey summaries focus on groups of people and often feature many statistics. Because expertise significantly affects design strategies, both novices (university students) and experts (professional product designers) are used as participants. Verbal protocol analysis of individual approaches to solving short design tasks is conducted, accompanied by a measure of situational empathy for each design task. The overall perceived quality of the design outcome is evaluated and analyzed in the context of how empathy was used in the development of that product.
Many statistical multivariate techniques were developed based on the assumption that the covariance matrices from different groups are equal. A well-known test for testing the equality of covariance is the Bartlett's test. However, the Bartlett's test is only a function of the volumes of covariance matrices not accounting for their shapes and orientations, and can suffer the curse of dimensionality in high-dimensional or big data case. In this work, we developed a modern Projection Pursuit Ellipse (mPPE) for high-dimensional data and compared its performance with the Bartlett's test and a few modern benchmarks for high-dimensional data. We also illustrate the implication of mPPE in big data applications.
First designated by Alcoa in 1954, 7075 has become widely used in the aerospace industry as a high-strength, lightweight material. This Al-Mg-Zn-Cu alloy can be processed to provide yield strengths in excess of 450 MPa. This alloy is commonly deformation-processed at high temperatures (T > 300°C) and a wide range in strain rates (0.001/s < strain rate < 10/s) in various forming operations, including forging. This project develops process maps to quantify the best processing window(s) in terms of both temperature and strain rate through the use of a unique MTS Advanced Deformation Simulator that resides in the Advanced Manufacturing and Mechanical Reliability Center (AMMRC) at CWRU. The initial studies on Al-7075 will then be extended to 3rd Generation Al-Li Alloys that are being targeted for a range of aerospace applications. The effects of sample size, lubricant used, machine alignment, and isothermal vs. nonisothermal processing methods will be reported.
A numerical model taking into account the random dispersion of nanofillers in a polymer matrix has been developed in order to predict the electrical percolation behavior of bulk and porous media incorporating 1D- carbon nanotubes (CNTs) and/or 2D-graphene nanoplatelets (GNPs).

The numerical model is able to predict the electrical percolation threshold of bulk systems applying vector calculus and linear algebra. A percolation volume of 0.67 and 8.67 vol% for CNTs and GNPs nanocomposites, respectively, is obtained assuming a perfect random dispersion and orientation of the nanofillers, showing a quantitative agreement with existing experimental observations. Incorporation of CNTs resulted in more efficient forming of a percolative network than GNPs, especially when using high-AR fillers. The percolation volume was found to decrease with the aspect ratio (AR) of CNT and GNP according to different relationships, while hybrid systems incorporating CNTs and GNPs exhibited significant synergistic effects when the two fillers were properly combined.

For the first time, a numerical model is used to predict the percolation threshold in the specific case of porous morphology, showing a decrease in percolating volume with porosity due to filler confinement within the pore walls. The parametric study of the present model can shed some light on how one can maximize the benefits arising from using different conductive fillers and tailor the polymer foam morphology to minimize the percolation threshold. Parameters to be studied include the effects of filler alignment, aspect ratio, and hybrid systems.
Chronic inflammation of longstanding duration has been implicated in the development and progression of various human pathologies including prostate cancer. However, its role in prostate cancer remains unclear. Bcl-2 is a survival protein that appears to lie at a nodal point in pathways leading to cell survival, cancer and therapeutic resistance. Similarly, proliferation cell nuclear antigen (PCNA) is a critical protein for DNA replication, repair of DNA damage, chromatin structure maintenance, chromosome segregation and cell-cycle progression. We examined the relationship between these two proteins under the influence of chronic inflammation and cancer progression. Using 38 prostate needle biopsy specimens obtained from patients with increased serum PSA and abnormality in the prostate gland, were stained for Bcl-2 and PCNA by immunohistochemistry. The location of the expression of these proteins in the specimens, differentiation between the infiltrating inflammatory cells, epithelium, and stroma was evaluated along with their association in a particular lesion. Bcl-2 was expressed widely in both inflammatory and epithelial tissue, however more intense expression was observed in the areas of chronic inflammation predominantly in infiltrating immune cells. The highest proliferation index was observed in the areas of high-grade PIN and cancer. An opposing correlation in the expression of Bcl-2 and PCNA was observed in the epithelium. The areas of chronic inflammation is associated with increased Bcl-2 expression, whereas the highly proliferative regions does not express Bcl-2. Our data suggest that during chronic inflammation, mainly infiltrating immune cells may secrete various factors that cause upregulation of Bcl-2 in adjacent prostate epithelial cells.

The effect of Bcl-2 make these particular epithelial cells a likely precursor population that may later develop into PIN and cancer.
Increasing use of steel storage racks across many industries and observed performance of the racks and pallet merchandise during past earthquake events has motivated development of seismic protective technologies for the racks. This research is developing a seismic base isolation system for cross-aisle rack response that can satisfy prescribed performance objectives for all potential rack load configurations. The large variation in potential load configurations and the rack aspect ratio play a key role in seismic response which may result in sliding, rocking, or combined slide-rock behavior. The combined behavior is developed from fundamental mechanics to understand the cyclic force-deformation behavior and equivalent damping provided which is used in the isolator seismic design methodology. The isolators consist of low-friction bearing surfaces, elastomeric mounts, and secondary stiffening elastomers which must be tailored in design to achieve performance objectives related to sliding and rocking displacements and probability of merchandise shedding (falling off a shelf). Design choices of isolator components are made through a weighted multi-objective optimization approach. The probability of merchandise shedding was considered in design through parametric seismic analyses of nonlinear sliding and rocking objects for varying seismic hazard levels. The mechanical behavior and design methodology are confirmed through nonlinear transient seismic analyses and full-scale dynamic experimental testing. The research on combined sliding–rocking behavior for the design of isolation systems is advancing the current state of knowledge and seismic design practice.
**Title:** Simple, High Sensitivity Magnetostriction Measurement System

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**Presentation Type:** Poster

**Elevator Speech:** Magnetostriction is the dimensional change for magnetic materials when magnetized. Large magnetization materials are used in Sonar systems. However, in most cases, magnetostriction leads to loss for applications like transformer and inductors. We present a simple, and sensitive device to measure the magnetization of materials quickly and accurately.

**Key Words:**

- Magnetostriction
- High sensitivity

**Abstract:**

Magnetostriction is the dimension change of magnetic materials induced by the change of its magnetization. Materials with large magnetostriction are used in highly sensitive naval sonar. However, in many applications (specifically the core for transformers and inductors) magnetostriction transfers the magnetic energy into mechanical energy, which is one of the mechanisms for loss. For these reasons, accurate measurement of magnetostriction is important. We established a strain gage based magnetostriction measurement system for small foil or thin-film samples. \[1\] Nb-Fe-B permanent magnets mounted on a rotating stage are used to provide uniform magnetic field up to about 2400 Oe to magnetize sample. An electric signal from the strain gage as a result of magnetostriction is filtered and amplified to ensure a good signal-to-noise before measurement using an oscilloscope. To further improve the signal-to-noise ratio the waveform data is acquired in average mode, which means that each of the data points is derived from averaging of 128 sample points collected during the experiment. Pairs of experiments with opposite direction of the voltage across the strain gage are conducted to remove voltage induced by the rotating magnetic field. Further data processing for the two separate data sets from a specific sample is done using Mathematica program. Validation measurements using Ni foil standards acquired – 34.58 ppm magnetostriction, which is in a good agreement with the -34 ppm \[2\] reported from literatures. The whole data acquisition and processing takes only minutes, and our system provides an easy and accurate method for magnetostriction measurements of small thin samples.


Abstract

ST266 is the secretory product of proprietary amnion derived cell that has been shown to reduce inflammation and accelerate healing of various wounds through promoting migration of keratinocytes and fibroblasts in pre-clinical animal studies. Skin erythema (sunburn response) is a type of skin damage caused by exposure to ultraviolet irradiation (UVR) that involves DNA damage and inflammation. This clinical study aims to evaluate the acute effects of ST266 on skin exposed to UVR in humans. Skin of 10 healthy volunteers were exposed to 2 minimum erythema dose (MED) of simulated solar radiation (SSR). The areas of skin of each subject that underwent SSR was subsequently treated with ST266 immediately or left as an untreated control site. ST266 was applied twice daily for 3 days. Each test site was then assessed for erythema compared to unirradiated skin. Skin biopsy samples of irradiated skin treated promptly with ST266 and irradiated, untreated controls were taken from each patient at 24-36 hours post SSR for evaluation of Xeroderma pigmentosum complementation group A (XPA) protein expression and cyclobutane pyrimidine dimer formation (CPD). XPA is an enzyme implicated in DNA repair and CPD is a marker for DNA damage.

At 24-36 hours, 48 hours, and 72 hours post SSR, irradiated skin with prompt ST266 treatment had significantly less erythema than untreated, irradiated skin (p= 0.00079). Immunohistochemistry staining of biopsy samples revealed marginally significant lower CPD levels with immediate ST266 treatment when compared with irradiated, untreated controls (p= 0.05). XPA expression levels demonstrated a trend towards higher expression in the ST266 treated group compared to the control, but were not statistically significant (p= 0.55).

This study showed the potential of ST266 as a treatment for UV-induced erythema and opens up the possibility for the investigation of ST266 in the reduction of UV-induced DNA damage and prevention of carcinogenesis.
Glioblastoma (GBM) is a highly malignant brain tumor that are usually found in the cerebral hemisphere of the brain. Surgical removal followed by radiation and chemotherapy is the standard care for GBM patient but the median survival time is only about 14.6 months and the two-year survival rate is only 30% with treatment. GBM is difficult to treat because any given GBM tumor consists of a heterogeneous population of cells including cancer stem cells with elevated therapeutic resistance and tumor propagation capacity. It has been shown that epidermal growth factor receptor (EGFR) over-expression is common and drives tumorigenicity of GBM. GBM cancer stem cells (CSCs) have the ability to undergo asymmetric cell division, which produce two daughter cells with different size, fate, and/or protein composition. Asymmetric cell division maintains the population of CSCs, and increase the heterogeneity of the tumor population at the same time. Targeted treatments like erlotinib (an EGFR inhibitor) has shown no significant improvement in survival rate in clinical trials. Interestingly, we found that EGFR inhibition increased the rate of asymmetric cell division in patient derived GBM CSCs and multiple growth factor receptors are co-enriched to one of the daughter cells during asymmetric division. In this study I will examine the effect of erlotinib and ligands that activate p75NTR in asymmetric cell division of GBM CSCs using quantitative single cell image analysis, and additional biochemical and functional analyses (such as quantitative PCR, Western blotting and cell-based analysis). These analyses will help to understand the biology of asymmetric cell division in glioblastoma stem cells and its role in therapeutic resistance.
Mini Mindfulness Intervention for Caregivers of Individual with Cancer

Purpose: Caregivers of cancer patients experience decreased quality of life and increased psychological distress and have been shown to experience increase risks of medical illness and death. Mini mindfulness intervention may decrease caregiver’s psychological distress and increase caregiver’s quality of life. The purpose of this study is to determine the effects of mini mindfulness intervention on informal caregiver’s quality of life and psychological distress when caring for cancer patients at the end of life.

Theoretical/Conceptual Framework: The theoretical models used for this randomized controlled trial include Pearlin’s Stress Process Model and Lazarus and Folkman’s Transactional Model of Stress and Coping.

Subjects: Study participants will include caregivers over the age of 18 years caring for a relative or friend with terminal cancer. Caregivers will be recruited from the Hospices Centers, University Hospital, and the Veterans Administration.

Methods: Eligible caregivers of cancer patients in hospice care living at home will be randomized to a control group (Group A) or experimental group (Group B). Group A, the control group will receive the usual care. Group B, the experimental group will receive usual care plus the mini mindfulness intervention. The caregiver’s quality of life and psychological distress will be measured with the Linear Analog Self-Assessment, Satisfaction with Life Scale, WHOQOL-BREF, QOL-NRS, Distress Thermometer, Distress Screening, Brief Symptom Inventory, and the Impact of Events Scale. During the initial face-to-face visit, consent forms will be signed, the mini mindfulness intervention will be delivered to Group B, and questionnaires will be completed. A nurse trained in the mini mindfulness intervention will deliver the mini mindfulness intervention to the caregiver. Caregivers will also be given written materials and website link during the first visit for usual care and the mindfulness intervention. Follow-up and questionnaires will be mailed or sent via email at baseline, two months, four months, 6 months, and a month after the death of the patient.
The Swagelok Center for Surface Analysis of Materials (SCSAM) is administered by the Case School of Engineering and is utilized by researchers from all across Case Western Reserve University. SCSAM is a multiuser analytical facility providing instrumentation for microstructural characterization of materials as well as surface and nearsurface chemical analysis. The equipment found in the center is maintained by six fulltime Ph.D. level engineers.

Elevator Speech
We offer microstructural characterization services to Case researchers and local companies and we will be interested to talk to any company that may have a need to use such equipment.
The shift in control of type 1 diabetes (T1D) treatment from parent to their child typically occurs during adolescence. Little investigation has been done to examine the link between parental mood and adolescent adherence. The relationship between caregivers and receivers in those with T1D is intricate and varying during adolescence. Due to this, understanding the role of parental cognitive and emotional states and how they influence their children’s ability to adhere to treatment plans is essential. The current study aims to investigate the relationship between parental depression, parental executive functioning, and adolescent adherence to type 1 diabetes. It is expected that more depression correlates with lower adherence and higher executive functioning deficits correlates with lower adherence. Executive function should act as a partial mediator in this relationship.
The nitrogen solubility in the austenite phase in the low alloyed Fe-X alloys with different alloying elements was calculated using the Calphad method available in the commercial thermodynamic software, Thermo-Calc. The selected alloying elements are Cr, Mn, and Mo. The results of the pseudo-binary phase diagrams (isopleths) of the Fe-X alloy as a function of nitrogen concentration are presented. The high temperature austenite region in the isopleths of the ternary phase diagrams of the Fe-X-N systems are then compared.

The enhancement of the nitrogen solubility in the Fe-X-N systems is essential in the production of the magnetic Fe16N2 phase. The commercial available software Thermo-Calc is an efficient and reliable method of discovering the appropriate alloy as the starting material.
Identifying the Critical Ingredients of an Evidence Based Practice (EBP)

EBPs are interventions intended to effectively treat people with various psychological disorders. Each EBP contains a variety of treatment criteria. Since implementation of EBPs with high fidelity is resource intensive, it would be helpful to know the most important criteria so providers could focus resources on implementing more critical components first. Many providers of ACT also provide IDDT since consumers with severe mental illness also experience substance use disorders. Currently, fidelity to ACT and IDDT is assessed separately – one unified assessment would be more efficient. 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 expert feedback. After examining the Delphi Method – an iterative approach incorporating expert feedback until consensus is reached – we determined our methodology would involve two rounds 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 asked to add any 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.
Praying mantises use visual information to track and pursue prey. Depending on their hunger, they will track prey by actuating their body joints, changing their body's orientation with their legs, or walking toward prey. Such directed behaviors are of interest because animals' nervous systems are highly distributed, so visual information from the brain must modulate the function of lower-level networks that control joints and limbs to produce coordinated output.

To test hypotheses about how these networks are modulated, we have built MantisBot, a 28 degree of freedom robot with a continuous-time neural control system. We are investigating two main questions about mantis prey tracking: first, what kind of descending signals might visual centers in the brain send to lower-level networks to control posture? Second, what kind of descending commands might be needed to transition between these behaviors, such as standing still and walking?

To begin to address these, we have built a head sensor with solar cells that can determine the position of a luminous target in space. These signals are used as feedback to orient the robot's head toward prey. We also present a framework for using visual information to modulate low-level control networks that allows for continuous transition from static posture, to postural changes that orient the head toward prey, to directed locomotion.
### Abstract

**Objective:** To determine the influence of the sonic hedgehog (shh) pathway, and its receptor smoothened (smo), on the survival and functionality of dopaminergic (DA) neurons.

**Background:** During development, shh induces the differentiation of DA neurons. However, it is unknown whether shh signaling is required in maintenance of DA neurons during late development and adulthood, due to the lethality of traditional shh knockout models. We utilized the cre-loxP system to achieve cell type-specific deletion of the shh receptor, smo, in DA neurons.

**Methods:** We evaluated knockout (ko) and wildtype (wt) mice using immunohistochemistry, gene expression, and behavioral tests. Number and size of DA neurons in ventral midbrain was measured by unbiased stereological quantification. The survival of DA neurons under stress challenge was examined in the unilateral 6-OHDA lesion Parkinson’s disease animal model and the function of dopaminergic system is examined by methamphetamine single and repeated challenges.

**Results:** TH positive neuronal counts and size in substantia nigra (SN) and ventral tegmental area (VTA) showed no difference between wt and DAT-smo ko mice in young (5 months) or aged (22 months) mice. Stereotaxic surgical injection of 6-OHDA led to loss of dopaminergic neurons in SN but no difference between wt and ko mice.

DATcresmo ko mice demonstrated hyperactivity compared to wt mice at 5 months. Despite the higher basal locomotion activity, DAT-smo ko mice showed diminished response to single and repeated METH challenge. Ko mice have lower gene expression levels for smo, Gli1 and BDNF in DA neurons.

**Conclusion:** Our study shows that smo function is not required for the survival of DA neurons during aging or under stress. However, it affects the behavior in young mice and their response to psychostimulant drug (METH), which indicates a role of smo in the functional changes that manifest at young age such as attention deficit hyperactivity disorder (ADHD).
Mitochondria are dynamic organelles that continually undergo cycles of fission and fusion. Dynamin related protein 1 (Drp1), an 80 kDa GTPase, is the main mediator of mitochondrial division. Through structural and functional studies, I am elucidating how Drp1 drives mitochondrial membrane fission.

Mitochondria are dynamic organelles that continually undergo cycles of fission and fusion. Dynamin related protein 1 (Drp1), an 80 kDa GTPase, is the main mediator of mitochondrial division. This process is important for the partitioning of daughter mitochondria during cell division as well as mitochondrial quality control and apoptosis. In disease, the balance of fission and fusion is disrupted, and excessive mitochondrial division leads to organelle dysfunction. In order to mediate membrane fission, we have shown that Drp1 can form large oligomers in the presence of membrane templates, and these complexes have the ability to impose a contractile force upon GTP hydrolysis. However, there is very little structural information regarding how Drp1 assembles to form the mitochondrial fission machinery. Using cryo-EM, we seek to reveal the structural features of this complex in vitro. We have identified conditions where Drp1 forms ordered helical assemblies on lipid templates and show how interaction with negatively charged lipid recruits Drp1 to the membrane surface. Moreover, we find that cardiolipin induces a unique Drp1 conformational change at the lipid surface. Further structural analyses have revealed that dimerization of the stalks and G-domains propagate the helical lattice. Therefore, these intermolecular Drp1 interfaces appear critical in driving the assembly of the mitochondrial fission complex.
Offshore floating wind turbines take advantage of the abundant wind energy resources at deep-water areas. The traditional design with gravity foundations are very expensive in deep-water, while a floating platform reduces the cost and opens the door to new large areas. However, new problems appear with the floating platform, including aero-hydro dynamic interaction between the wind and the ocean waves, which reduces the energy production and increases the mechanical fatigue. Classical methods for performance analysis and controller design of floating wind turbine platforms mostly focus on computer modeling and simulation. However, these approaches hardly simulate the complexity of the real problem. Additionally, the experimental floating platform prototypes and the equipment for ocean wave generation are extremely expensive and inaccurate.

Our research proposes a new low-cost approach for experimental analysis of offshore floating wind turbines. We design and manufacture a new lab-scale wind turbine with a floating platform based on a 6-DOF Stewart platform. The new prototype is validated experimentally in the wind tunnel at the Control and Energy System Center (CESC) at Case Western Reserve University. Simulated ocean waves, including sinusoid and random ocean waves based on ocean wave spectrum are generated by the Stewart platform. The Cp/lambda characteristic of the wind turbine prototype is identified experimentally under a variety of floating platform situations and analyzed for further research.
Microcephaly is found in isolated or syndromic forms of neurodevelopmental diseases and may be associated with brain structural abnormalities, intellectual disabilities and seizures. Mutations in DNA repair genes lead to microcephaly, demonstrating that the maintenance of genomic stability is crucial for proper brain development and size. However, its pathogenesis is poorly understood.

We generated induced Pluripotent Stem Cells (iPSCs) from healthy control patients as well as microcephalic patients with known mutations in the DNA repair pathway genes LIG4, PNKP or NBN. We used these iPSCs to generate neuronal precursor cells (NPCs), cortical neurons, and 3D cerebral organoids, which allowed us to study proliferation, apoptosis, differentiation and early self-arranged neuronal structures in organoids.

Our results indicate that causative mechanisms of DNA-repair-related microcephaly arise during early stages of brain development. Specifically, we found that NPCs derived from LIG4-iPSCs prematurely differentiated into neurons, and also displayed increased apoptosis. In addition, when directly differentiated into neurons, LIG4-iPSCs differentiated more rapidly compared to control cells. However, 2 weeks after transduction, the LIG4 neurons displayed increased cell death compared to controls. Finally, LIG4 cerebral organoids were 2 times smaller than the control organoids during the first 4 weeks of formation. Immunostaining of LIG4 organoid sections showed an increase in cleaved Caspase 3 compared to the controls, further supporting a role for apoptosis in microcephaly. In summary, we were able to recapitulate human microcephaly due to mutations in DNA repair genes in vitro. Our models suggest that premature differentiation of NPCs followed by apoptosis of neuronal cells might play a significant role in microcephaly. We believe that these models will allow us to further dissect important mechanisms underlying the pathogenesis of DNA repair-related microcephaly.
Abstract

Sudden Infant Death Syndrome (SIDS) remains the leading cause of infant death beyond one month of age. Preterm and low birthweight infants, including multiples, are at increased risk. Adherence to American Academy of Pediatrics (AAP) SIDS Risk Reduction Recommendations is especially challenging for families with multiple newborns. Economic and space constraints can prohibit a separate sleep surface in the parents’ bedroom, and mothers are less likely to breastfeed. This study describes knowledge and practices of mothers caring for higher-order multiple birth infants. 

Fourteen women caring for their first set of higher-order multiple infants were recruited through the Raising Multiples Facebook page. AAP SIDS and Other Sleep-Related Infant Deaths Recommendations (2011) guided the previously piloted survey items. Ten mothers of triplets and four mothers of quadruplets completed the online survey. The highly educated sample was mostly white non-Hispanic, married, and from a variety of geographic regions in the United States. Mean infant age at the time of the survey was nine months; mean infant gestational age at birth was 32 weeks. When babies first arrived home, 11 sets of multiples were placed on their backs for nighttime sleep, ten were placed on their backs for naptime sleep, four shared sleep surfaces, and seven room-shared with the parents. Besides cribs or bassinets, swings and portable cribs were the most common sleep surfaces. Eleven sets were fed breast milk, and only four were offered pacifiers for every sleep. During the pregnancy only one set was exposed to tobacco smoke from someone in the household. Results indicate a need for safe sleep education for families with higher-order multiples. Nurses can use knowledge gained from this study to target unique education needs of these families and reduce risk for sleep-related infant mortality.
Some centrifuge tests of bucket foundation under static lateral loading were performed at Case Western Reserve University. In this presentation, 2 finite element models of aspect ratio (L/D, where L is the skirt length and D is the foundation diameter) 0.5, 1.33 were built at first based on the centrifuge model. The load-displacement curves of the numerical analysis and test results were compared to verify the reliability of the FEA methods. Next, several 3D numerical models of aspect ratio varied from 0.2 to 2.0 were built to evaluate the effect of the aspect ratio on the lateral-moment bearing capacity and to study the failure mechanism for different L/D ratios. Finally, a series of 3D FEM were performed to analyze the sensitivity of the parameters of material property and the position of the load.
Iron oxide nanoparticles (IONPs) with high spin-spin relaxivity (T2) are desirable as contrast agents for magnetic resonance imaging (MRI) applications. Generally, IONPs with ideal magnetic properties for bioimaging applications can be prepared by either optimal incorporation of heteroatoms into the crystal structure or tuning the nanoparticle morphology. Particularly, changes in the morphology via different chemical etching processes have shown an enhancement in T2 relaxivity due to the enhanced magnetic anisotropy induced by asymmetric nanoparticle structures. In our study, we introduce a novel method of synthesizing high-index faceted iron oxide concave nanocubes through a systematic replacement of a non-coordinating solvent, 1-octadecene, with a bulky coordinating solvent, trioctylamine, during the thermal decomposition of an iron-oleate metal precursor. The selective binding of trioctylamine onto the nanoparticle surface has transformed the overall morphology of the IONPs from spheres to concave cubes. The resultant shape anisotropy of the concave nanocubes significantly affected the magnetic properties of the IONPs and led to a 6-fold enhancement in T2 relaxivity making it a good candidate for MRI applications. Further studies on the effects of the oleic acid used as a capping surfactant in the IONPs synthesis showed the formation of another high-index faceted nanostructure, sea-urchin-like IONPs with similar T2 relaxivity, when low concentration of the surfactant is used.
Abstract

Among environmental risks, lead exposure is perhaps the most serious threat to a child’s development. Lead is a known neurotoxin that, when ingested, can lead to brain and nervous system damage and, subsequently, cognitive deficits, developmental delays, and behavior problems. There is no safe level of lead in a child’s blood; cognitive deficits have been associated with blood lead levels well below the public health community’s current standard for concern (>5 µg/dL). For cities like Cleveland, with an industrial past and considerable pre-1978 housing stock, childhood lead exposure is a significant problem. The number of children with elevated blood lead levels has been declining over the past decade; however, these point-in-time estimates mask cumulative exposure to lead in the early childhood period. That is, the number of children under the age of six who have ever been exposed to lead in the period between birth and kindergarten entry.

Using integrated data maintained at the Center on Urban Poverty at the Jack, Joseph and Morton Mandel School for Applied Social Sciences, this poster presents cumulative lead exposure rates by birth cohort for children living in the City of Cleveland. Based on lead testing data on over 14,000 children per year, our analysis provides an overall view of the lead burden within the city as well as lead’s disproportionate impact on certain neighborhoods. In recognition of the long-term consequences of lead exposure, we also explore associations between lead exposure that occurred before the age of six and distal outcomes such as academic performance and juvenile justice involvement.
Abstract

Purpose
Comparison of the efficacy of 18F-FDG PET/MR, 18F-FDG PET/CT and dynamic susceptibility contrast (DSC) perfusion MR histogram analyses to evaluate imaging progression in post therapy GBM to differentiate between tumor recurrence (TR) and radiation necrosis (RN).

Materials and Methods
Our study included 24 patients with 28 lesions, M: F (16:8), age range of 34-81 years. Inclusion criteria: initial diagnosis of GBM post standard treatment regimen with imaging progression on follow up imaging. All patients underwent 18F-FDG PET/MR and perfusion MR in a single exam. 19 patients also underwent 18F-FDG PET/CT on same day (single FDG dose). Final diagnosis was confirmed by pathology in 17/24 and by imaging and clinical follow-up in 7/24. For quantitative PET/MR and PET/CT analysis a PET edge detection tool was used to draw region of interest (ROI) around the suspicious lesion (L) and in contralateral white matter (C) and relative maximum, mean and median (r-max, r-mean, r-median) values were calculated for each lesion using the L/C ratio. For perfusion analysis, ROI was drawn around the lesion on rCBV (relative Cerebral Blood Volume) maps and histogram metrics were calculated.

Results
6 lesions had RN and 22 had TR. For PET/MRI, r-Mean values with a cutoff=>1.31 were most effective in differentiating TR from RN yielding a sensitivity, specificity, NPV and PPV of 100%, 80%, 100% and 94.7% respectively. For PET/CT r-Mean values with a cutoff=> 1.47 yielded sensitivity=83%, specificity=80%, NPV=57.1% and PPV=93.8%. Analysis of rCBV histogram metrics revealed that mode, mean, and median measures were statistically significant. Perfusion mode values with a cutoff>=3.39, yielded sensitivity=77.8%, specificity=100%, NPV=50% and PPV=100%.

Significance of Conclusions
Our results suggest that PET/MR analysis is the most efficient method of differentiating between radiation necrosis and tumor recurrence as compared to quantitative PET/CT analysis and DSC pMRI histogram analysis.
The behavioral health industry has seen increasing attention paid to the use of EBPs: complex service models that have been shown with empirical support and replication to successfully treat the needs of their target population. High fidelity implementation of these practices is difficult due to their clinical and structural complexity as well as economic constraints. The application of implementation science to behavioral health research allows investigation into the needs and barriers to installing novel treatment modalities with fidelity into real world settings.

Integrated Dual Disorders Treatment (IDDT) is an EBP recognized by SAMHSA to be effective in the treatment of individuals with co-occurring severe mental illness (SMI) and substance use disorders. This poster reports on a targeted review of the literature with the aim of evaluating the strength of evidence behind each component of IDDT.

Methodology: first, the investigators examined the 87 studies listed in the SAMHSA IDDT Toolkit. Next, all relevant studies citing a paper on that list or being cited by a paper on that list were reviewed. Finally, Medline, PsychINFO, and Google Scholar were searched with the key words co-occurring disorders, dual diagnosis, and integrated dual diagnosis treatment, each paired with the key words from each item on the IDDT Fidelity Scale.

The targeted literature review was the first stage of a larger project aimed at identifying the critical ingredients of IDDT. The ultimate goal of the project is to use the knowledge gained to improve the assessment and implementation of these dual diagnosis critical ingredients on Assertive Community Treatment (ACT) teams, another EBP for the treatment of people with SMI.

In addition to the implications for the treatment of a high need population, this study presents a methodology that can help advance the mission of implementation science and improve outcomes across many areas of behavioral and physical health practice.
Animals are remarkable in their ability to flexibly and robustly respond to changing conditions in their environment. Understanding the neural mechanisms of this process could be of great value. Previous studies in the marine mollusk Aplysia californica have shown that its response to mechanical loading while feeding is complex. When mechanical loads are small, the animal recruits a stronger muscular response to generate more force. When mechanical loads become large enough to potentially injure the feeding apparatus, the animal may cut food and release it. What are the neural correlates of this behavior? We have recently developed a suspended buccal mass preparation in which it is possible to look at neural correlates during biting and swallowing while applying different mechanical loads. Our preliminary results suggest that 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. These results suggest a neural mechanism whereby animals can flexibly adjust the output of their motor system in response to mechanical load and thus may be of general interest.
Factors Contributing to Inpatient Admission of Pediatric Patients with Skin and Soft Tissue Infections (SSTIs), a Retrospective Chart Review

Background:
Rising incidence of SSTIs along with increasing drug resistant pathogens is a challenging medical problem with high costs. Previous studies have focused on limiting resource utilization by managing “low risk” patients in outpatient settings and streamlining care for patients requiring inpatient admission. This study aims to reduce admissions by identifying factors influencing the decision to hospitalize pediatric patients with SSTIs.

Methods:
395 patients aged birth to 18 years admitted to a single institution from December 2011 to June 2015 were identified via an administrative database, selecting ICD 9 discharge diagnosis SSTI. Patients with comorbidities, and infections of deep neck, mastoid process, or orbit were excluded. Admission criteria were signs of systemic illness, oral antibiotic intolerance, worsening after 48 hours oral antibiotics, rapid progression, need for pain control or parenteral rehydration, or inadequate follow-up. Demographic and clinical characteristics were compared between the two groups, those who do and do not meet admission criteria.

Results:
Of 395 patients, 171 (43%) met admission criteria: 102 (59.1%) worsened despite oral antibiotic treatment, 22 (12.9%) had rapid infection progression, 24 (14%) had systemic illness signs/symptoms. The 2 groups shared similar presenting features (WBC count, inflammatory markers, and fever > 39C) and were equally likely to undergo incision and drainage (I&D). The mean (IQR) age was 2 years. Younger patients were most likely to not meet admission criteria: 75.0% <1 year, 56.1% 1-5 years, 43.3% >5 years (p<.0001). Of 227 patients who underwent I&D, 184 (81%) occurred the operating room (OR), and only 21(<10%) in the sedation unit or inpatient floors.

Conclusions:
This study suggests a significant number of patients with SSTIs could be managed in outpatient settings. Admitted patients could
Over the past decade, interest in iron oxide nanoparticles has increased considerably due to their unique properties and their potential in biosensing, drug delivery, magnetic hyperthermia, and magnetic imaging applications. In this study, the magnetic behavior of iron oxide nanoparticles is optimized by systematically tuning its size, shape, and the amount of zinc-dopant. The magnetic properties of the synthesized zinc-doped iron oxide nanocubes is compared to the undoped spherical iron oxide nanoparticles of equal volumes. The results from this study demonstrated the enhanced magnetic properties of iron oxide nanoparticles through incorporation of zinc-dopant and changes in shape anisotropy. Subsequently, the water dispersity of zinc-doped iron oxide nanocubes was explored through modification of the nanoparticle surface chemistry. Furthermore, the magnetic hyperthermia properties of the optimized zinc-doped iron oxide nanocubes and its performance in antibacterial applications were also evaluated.
**Title**

*Flow Virometry Toolset for Nano-Level Functional Virologic Inquiry*

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**Elevator Speech**

HIV displays an extremely high level of genetic diversity, which poses a challenge to therapy and cure efforts by creating drug and antibody resistance. Additionally, only one in a billion viruses is communicated and can establish infection. Currently, we have no way of analyzing single viruses individually for infectivity. Using a single-virus flow approach, we are able to determine fitness parameter distribution in a virus sample, and isolate the viruses most likely to be infectious for genetic flows.

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**Abstract**

Flow cytometry has revolutionized our understanding of cell biology and immunity by tracking internal and external cell markers during normal developmental processes and the course of infection. Relatively recently, it has become clear that cells release microvesicles and endosomes, important intercellular communication media carrying biological cargo, such as proteins or RNA. The recognition of extracellular vesicle (EV) importance in cancer and normal cellular interaction has spurred new flow cytometry-based approaches to explaining their composition and function. Coincidentally, viruses that originate within our cells tend to share morphological commonalities (such as size) with EVs and to be released through analogous pathways. With the advancements in small particle detection by new-generation flow cytometers, or with some ingenuity and the standard flow cytometer, we may now explore and classify the immunological makeup and functional characteristics of the live virus with unprecedented detail. It is also possible to isolate particularly infectious populations, providing sharper focus to downstream vaccine and antiviral drug design efforts. The method, monikered “Flow Virometry”, is useful in enhancing our understanding of the functional diversity of highly changeable viruses, such as HIV. It also allows us to easily quantify viruses in samples, potentially replacing the burdensome, expensive and variable ELISAs used daily in virological laboratories world-wide.

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**Key Words**

- flow
- cytometry
- HIV
- virometry
- functional

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Flow Virometry Toolset for Nano-Level Functional Virologic Inquiry
## Abstract

Enzyme activities in human blood are critical indicators of different clinical conditions. The electrochemical pH-stat, a unique approach to measure enzyme activities, has been developed in our laboratory. It is a simple diagnostic device that can cover a wide range of enzymes of clinical importance using one microfabricated analysis slide. The pH-stat holds two microliters of sample and is composed of a sample chamber embedded with three electrodes. The enzyme-containing sample is wicked into chamber via capillary action. Mixing within the chamber is achieved by passive diffusion. The pH sensing electrode constantly monitors the pH inside the chamber, sending feedback to a software control program, which then determines the direction and the amount of current to be injected through the working electrode. The current causes water-splitting and thus can be used to maintain the pH at a desired level despite the ongoing enzyme reaction. The injected current is directly linked to the rate of substrate conversion. The proposed device has the potential to be implemented for point-of-care enzyme assays, significantly accelerating the measurement while lowering the costs.
A Password-Protected Website for Mothers Expressing Milk for Their Preterm Infants

**Background:** Preterm infants spend weeks or months hospitalized in Neonatal Intensive Care Units (NICUs). Research has demonstrated that breast milk significantly decreases morbidities that impact length of stay for preterm infants, but there is a need to test interventions to improve breastfeeding outcomes. Since many Americans are using the Intranet and smart phones to find health information and manage health, a website was developed for mothers who provide breastmilk for their preterm hospitalized infants. Former U. S. Surgeon General, Dr. Regina Benjamin stated “… use of electronic communication channels opens many new possibilities for promoting breastfeeding”.1

**Purpose:** This study evaluated the new website for mothers to educate them about breastmilk expression and assist them in monitoring their breast milk supply.

**Methods:** Quantitative and qualitative data were collected from mothers whose preterm infants.

**Results:** Eighteen mothers participated in evaluation of the website. Thirteen mothers consistently logged on to the website (m (SD) = 13.3± 11.7) times. Most participants, (69.2%), reported they used the breastmilk educational information. Most mothers indicated using the website log helped in tracking their pumping. These findings can be used to direct the design and development of web-based resources for mothers of preterm infants.

**Implications for Practice:** NICU staffs need to examine and establish approaches to actively involve mothers in monitoring the establishment and maintenance of an adequate supply of breastmilk.

**Implications for Research:** A supportive and informative website for breastfeeding mothers of infants in NICU which incorporates features identified in this study should be developed and tested.

**References**

Additive manufacturing (AM), also known as 3D printing, has been of great interest in various fields due to its freedom in structure design and efficient use of materials. Fused Deposition Modeling (FDM) is one of the most commonly used and cost-effective techniques in AM. However, printing flexible materials always remains a challenge in FDM. In this study, we aim to print TPU/graphene oxide (GO) nanocomposite by using FDM. TPU is a highly flexible polymer with excellent mechanical properties, and GO has an anti-microbial effect. The printed composite can be used in tissue engineering. In order to print flexible TPU, poly(lactic acid) (PLA) is used to blend with TPU/GO to increase the hardness of the composite. The mechanical properties can be tailored by controlling different ratios of TPU to PLA.
Objective: The objective of our study was to observe the influence of social disparities on dental caries among children registered at different Head Start sites located throughout northeast Ohio.

Methods: A chart review was conducted of 195 patients enrolled in various Head Start sites located throughout northeast Ohio. The number of decayed primary teeth (dt) was recorded as the outcome. Social disparities in this study were measured by whether the fluoridated water was supplied in the city and the number of dentists who accepted Medicaid per 10,000 children (D_density). To control potential confounders, age, gender, number of present primary teeth, and the population of the city per kilometer (P_density) were used for analysis.

Results: The mean (SD) of the patients’ age was of 3.04 (1.13) years (range was from 7 months to 7 years old). 104 (53.33%) were boys. Eighteen cities were observed. Fifteen cities were supplied with fluoridated water. The mean (SD) and range of D_density were 80.40 (150.25) and 0 to 624.18, respectively. The mean (SD) and range of P_density were 1428.30(1051.15) and 540 to 4825.77, respectively. ANOVA analyses were conducted for the differences of dt among cities and indicated significant differences (F=2.38, p=0.002). Regression model analyses for dt indicated that fluoridated water supply was negatively associated with dt (a significant regression unstandardized coefficients (B) (SE) and 95% CI of fluoridated water was -0.772 (0.284) and -1.33 to -0.211). However, B of D-density did not indicate significant level- (B(SE)=0.001(0.001) and 95% CI: -0.002 to 0.004).

Conclusion: Fluoridated water supply was indicated as a social disparity among Head Start children in northeastern Ohio.
INTRODUCTION: Children with a wide variety of growth disorders are receiving GH treatment such as GH deficiency (GHD), Turner syndrome, chronic renal failure, children born small for gestational age, Prader-Willi syndrome, juvenile chronic arthritis and cystic fibrosis. One of the most striking side effects of recombinant growth hormone therapy (rhGH) is idiopathic intracranial hypertension (IHH). IHH is usually very rare in children and infants. However in pediatric population receiving rhGH therapy the risk increases 100 fold. If untreated IHH may cause neurological abnormalities, strabismus and even vision loss. The most important symptom of IHH is headache but this is not much use in inarticulate pediatric population. Papilledema is an important and easy to find sign for IHH. Even though naked eye fundoscopy is able to diagnose advanced papilledema fairly easily, it can miss subtle changes leading to papilledema in the optic disc. Optical coherence tomography (OCT) is a non-contact and easy to operate device to image retina and optic disc. It can easily detect the subtle changes occurring on optic disc hence show us papilledema much before naked eye can detect it.

CASE REPORTS: We report 4 cases of two males and two females treated with recombinant growth hormone due to growth hormone insufficiency and renal dysplasia. When their average growth hormone dose exceed 0.4 mg/kg/week we started to see subtle changes with their optic disc and they were evaluated with OCT for retinal nerve fiber layer thickness. We were able to detect an average of %30 increase in retinal nerve fiber layer thickness which went back to normal after growth hormone dose was reduced or stopped.

CONCLUSION: We recommend screening children who are under growth hormone therapy with OCT to detect papilledema and IHH much before than naked eye and prevent the complications related to IHH such as blindness and strabismus.
Objectives: The purpose was to examine the proportion of specific pulpal and periradicular diagnoses by the presence of restorations placed prior to NSRCT (non-surgical root canal treatment). Methods: From a review of the CWRU Endodontic Department records, 2006-2014, 458 subjects who received an NSRCT on unrestored (n=98), amalgam-restored (n=159) or composite-restored (n=201) teeth were identified for inclusion. Pulpal diagnoses were 14.6% ASIP (asymptomatic irreversible pulpitis), 40.8% SIP (symptomatic irreversible pulpitis), and 44.5% PN (pulpal necrosis). Periradicular diagnoses were 25.3% Normal, 17.7% ASAP (asymptomatic apical periodontitis), 46.9% SAP (symptomatic apical periodontitis), and 10% AA (apical abscesses). The association of endodontic diagnoses with restorative material, stratified by number of surfaces restored (<3 versus ?3) was examined; Mantel-Haenszel (MH) odds ratios (OR) were calculated after tests of homogeneity.

Results: Subjects included 63.3% females and 36.7% males with a mean age of 33.4 years. Patients with unrestored teeth were younger (23.1 years) compared to those with any restoration (36.2 years). Mean age did not differ by endodontic diagnoses (p > .05). Bivariate analysis showed that 54.9% of PN teeth and 65.2% of AA teeth presented with composite restorations; 37.3% of PN teeth and 43.4% of AA teeth had ?3 restored surfaces. From the stratified analysis, teeth with PN had 2 times greater odds of presenting with composite (versus amalgam/no restorations) compared to less severe diagnoses, after adjusting for the number of restored surfaces (ORMH = 1.97; 95% CI = 1.33, 2.00). A similar association was observed for restorative materials and AA (ORMH = 2.28; 95% CI = 1.19, 4.40). Tests of homogeneity for both stratified analyses were not significant. However, modest confounding was observed when comparing crude and adjusted ORs.

Conclusions: Our data supports an association between endodontic diagnosis and restorative material, even after adjustment for number of restored surfaces. One interpretation is that teeth requiring multi-surface restorations had compromised pulp initially. The results may be indicative of the importance of pulp testing prior to, during, and after placement of a restoration.
Abstract

The performance of a wind turbine inside a wind farm differs from the nominal performance of the wind turbine alone. Turbines in wind farms are affected by the wake of other turbines, reducing the energy production and increasing the mechanical fatigue. Park models and Eddy-Viscosity wake effect models are currently used for wind farm analysis and design. The high cost of any modification of an existing wind farm limits the studies reported in the literature to just fixed layout farms or computer simulations. The Control & Energy System Center (CESC) at CWRU has developed a new experimental and low-cost methodology to analyze and improve the performance of wind farms. This research shows the results of the interaction of a number of lab-scale prototypes in the CESC wind tunnel under different wind speed and wind farm layout scenarios.
The recent years show growing interest in wind energy as a power resource that can be employed to maintain power sustainability at the point of interconnection with the grid. As wind energy penetration increases, the grid operators need more flexible voltage control capabilities of the wind farms. The current approach used by the wind turbine manufacturers deals with fixed reactive power reference look-up tables to help the grid operator controlling the voltage. 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 flexible voltage control and 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 experimentally with lab-scale wind turbines connected to the electrical grid and with the fully instrumented wind tunnel at the CWRU Control and Energy Systems Center.
A neurological condition characterized by recurrent seizures not caused by other illness. Epilepsy affects two million people in the United States, and forty-five million people worldwide. The majority of new-onset adult epilepsy cases are idiopathic, and approximately 22.5% of those diagnosed have drug-resistant epilepsy. Patients unable to treat their epilepsy pharmacologically are at high risk of premature death, neurological dysfunction, injury, reduced quality of life, and sudden unexpected death in epilepsy.

While refractory epilepsy can be difficult to treat, it can be monitored by observing electrophysiological activity. Electroencephalography (EEG), a measure of brain activity, is the current gold standard for epilepsy monitoring. Neurologists can use EEG to diagnosis epilepsy, evaluate seizure characteristics, and evaluate patients for treatment. EEG monitoring is commonly performed in an inpatient setting and severely restricts the movement of patients.

We will present a portable and wearable medical device that will allow remote EEG monitoring and automatic epilepsy detection. EEG will be acquired with the use of a multi-channel wireless headset. Epilepsy detection will be performed in real-time with the use of multitaper nonparametric spectral estimates from the EEG and semi-supervised machine learning on an android-based platform.

It is expected that this device will give epilepsy patients greater autonomy and independence in their daily lives.
Background
Dental caries and asthma are the two most common chronic conditions affecting children in the United States. The aim of this study is to identify potential common risk factors of these two diseases. Thus, allowing for the development and implication of more specific and effective prevention and outreach programs.

Methods
A case-control study of a group of 364 infants recruited from a longitudinal study was completed. Children were classified as having either asthma, decay, or both diseases at the age of 36 months. Demographic, health history, and lifestyle factors were examined in relation to both asthma and dental caries. Multinomial regression models were utilized to assess potential risk factors at the individual and community levels for the development of caries, asthma, and both diseases.

Results
A total of 92 (25.3%) children had only decay, 62 (17.0%) had only asthma, 35 (9.6%) had both caries and asthma, and 175 (48.1%) children had neither disease. The common risk factors for both asthma and caries include having a low social-economic status, utilizing a feeding plan other than exclusive breastfeeding, and residing in dental HPSA scored area were common risk factors for both caries and asthma.

Main Conclusion
It is essential to target low income communities with prevention and outreach programs to reduce the prevalence of dental caries and to promote better control among asthmatics. It is also important to promote breastfeeding as the preferred feeding plan to aid in the prevention of dental caries and asthma.
### Presentation ID

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Type: Oral Presentation

Title: Reducing Cleveland's Infant Mortality Rate by targeting racial disparities through the Costa Rican healthcare model

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**Elevator Speech**

This research can significantly impact the city of Cleveland's current approach to IMR. Drawing from my experiences in Costa Rica, remodeling the initiative to tackle such an immense issue is of utmost importance and one which adequate distribution of time, money and resources should be allotted to.

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**Key Words**

Infant Mortality Rate, Cleveland, Costa Rica, Racial disparities

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Abstract

Infant Mortality Rate (IMR) has been a growing problem in Cleveland, with the past five years yielding an average of 13 deaths per 1,000 live births all before the age of one (Ohio Department of Health 2013). This is significantly contrasting with the statewide average 6.8 in 2014. Separating that value, two racial groups stand out with their own IMR values in Ohio in 2014: blacks (14.3%) and whites (5.3%) (Zeltner, 2015). As of 2014, African Americans comprise over 53% of Cleveland's population, while whites comprise just over 37% (US Census Bureau 2014). This highlights the immense health disparity amongst racial groups in Ohio, and a greater reflection upon the Cleveland area. Cleveland boasts two of the worlds premiere hospitals, ranking in the top ten amongst multiple specialties: the Cleveland Clinic and University Hospitals. With state of the art technology, medical equipment, and cutting edge procedures staffed with the some of the greatest minds of our age it is extremely hard to associate Cleveland with such a high IMR value. Contrasting with these startling statistics, Costa Rica has one of the lowest IMR values in the world standing at 8.46% according to a 2015 estimate (CIA World Factbook). In 2013, Costa Rica households spent on average 9.9% on total health expenditure, which is the sum of both private and public health expenditures (The World bank 2016). Based on these challenges, especially the disparity in outcomes between whites and blacks, the most important intervention to address IMR in Cleveland would be to establish preventative care methodologies such as: alleviating the socioeconomical barrier that is present especially amongst African Americans and Whites, promoting boundary spanning and collaboration special interest groups, and prenatal and postnatal education because doing so would promote equitable access to resources for those communities at greatest risk, as demonstrated by the successful preventative care approaches in Costa Rica.
Effective gait control for a worm-like robot requires accurate body segment coordination. For more precise control, we have incorporated sensory feedback that could help the robot to reliably locomote through pipes of different diameters by regulating contact forces. Each segment of the robot is driven using a servo actuator attached to a cable that tightens segments circumferentially. Longitudinal springs help return segments to the original maximum diameter. The servo actuators have load sensing capabilities, which, while noisy, can help in detecting the wall of a pipe. As a segment comes in contact with a pipe, the compliant structure of the robot deforms and slack is introduced in the actuation cable. The robot predicts if slack has been introduced in the cable by calculating the probability of a particular load value occurring at a given instance (based on training data). When this probability crosses a preset threshold, segment extension stops. This should help the robot detect the limiting diameter of a pipe and make the resulting peristaltic locomotion more efficient. In future, these feedback responses will be incorporated in dynamical oscillator networks, like stable heteroclinic channels (SHCs).
Title: The Effects of Binge Drinking, Substance Abuse, and Depression on Emotional Perception

Abstract

This study explores the similarities and differences between binge drinking, substance use, and depression and their effect on emotion perception bias. First, participants complete 11 online questionnaires that ask them about their substance usage, reasons for their usage, possible depressive symptoms, and medical history. Some of the participants are then selected to come into the lab to perform two tasks: an emotional Go-No-Go (GNG) task and an emotional response task. During the GNG, participants are hooked up to an electroencephalograph (EEG) to monitor their brain waves. The EEG is then removed and they perform the emotional response task. They are asked to go over the faces again and rate the strength of their responses, positive or negative, to the faces. Participants and the task screens are filmed during this process so researchers can match up the EEG data with the face that each participant was viewing at that time. Researchers will then examine the participants’ response ratings. The researchers predict that there will be a correlation in the responses of the binge drinking participants and the depressed participants, and that the effects will be greater in the participants who fall into the binge drinking and depressed categories.
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**Title** | **The Measurement of the Anisotropy of Resistivity of Vanadium Pentoxide (V2O5) Nanostructures**

**Author Status** | **Author Affiliation** | Case Western Reserve University
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**Published?** | **Presentation Type** | True | Poster
**Elevator Speech** | The anisotropy effect of the resistivity of thin films of Vanadium Pentoxide has scientific importance and may also have practical applications.

**Key Words**
- anisotropy of resistivity
- Vanadium Pentoxide
- thin nanoflake

**Abstract**
Vanadium Pentoxide (V2O5) has layered crystal structure and can be exfoliated to very thin flakes with a thickness of nanometers or less. Atomically thin films of V2O5 embody some properties very different from those of bulk V2O5. Drastically enhanced anisotropy of electrical resistivity might be one of these properties exhibited by V2O5 samples with thickness approaching atomic scale. The resistivity is isotropic for a bulk V2O5 but the anisotropy of resistivity was expected for thin films of V2O5. The value of the anisotropy factor of resistivity of thin films of V2O5 will be experimentally determined.
Biohybrid and organic robots powered by the I2 muscle from Aplysia californica

Two techniques have been investigated for fabricating biohybrid and fully organic robots powered by the I2 muscle from Aplysia californica. Aplysia californica relies on an open circulatory system, making its musculature ideal for use in bio-bots. Additionally this sea slug is extremely robust, living in tidal regions with varying temperatures and osmotic balances. The I2 muscle from the Aplysia feeding apparatus has been chosen as an actuator due to its thin structure, allowing nutrients to penetrate the muscle via diffusion, and the existing knowledge of the neural structures which control it. This muscle has been characterized using a deflected cantilever technique and it has been found to produce a force of at least 30 mN; although previous literature indicates that it may be capable of producing force up to 120 mN. Additionally, the muscle has reasonably long durability, being capable of continuously contracting for up to 3 hours. In the first technique biohybrid robots have been fabricated using a Formlabs 1+ SLA 3D printer. This printer is capable of printing flexible structures which the I2 muscle can deform when attached. The second technique fabricates completely organic devices by molding the I2 muscle into a gel scaffold made from collagen isolated from the skin of Aplysia californica. The technique produces a soft, hydrogel scaffold around the muscle. Both techniques have been investigated for their ability to produce locomoting devices.
Three generations of supramolecular core-shell polymers are fabricated through simply mixing two components. The core structure is hyperbranched polyethylenimine (PEI), while the shell structure is carboxylic acid-terminated carbazole-containing dendrons. Three generations (G0, G1, G2) stands for different number of outside carbazole groups. G0, G1 and G2 contains one, two, four carbazole groups, respectively. The formation of the core-shell polymers are due to ionic interaction between PEI and dendrons. Dynamic light scattering (DLS) and water contact angle (WCA) test have been performed to verify the formation. At the same time, Fourier transform infrared (FTIR) spectra and nuclear magnetic resonance (NMR) spectra are performed to verify the ionic bonding. The core-shell polymers have two notable applications. One is to encapsulate anionic guest molecules (nanocarrier) and the other is reduce metal ions and form metal nanoparticles without any additional reduce agent (nanoreactor). The encapsulate capacity is monitored through ultraviolet-visible (UV-vis)spectra and the metal reducing property is monitored through scanning electron microscope (SEM). The material broad the approach to optoelectronic devices and intelligent materials.
Abstract

Individuals suffering from microstomia show reduced oral aperture which may impact quality of life. This case report outlines the details on fabricating a custom made complete swing lock prosthesis to restore masticatory function in an edentulous patient. An industrial hot tar incident left the patient with severe microstomia with perioral scar tissues. One of the unique aspect is that the case is completed in the undergraduate dental clinic at Case Western Reserve University with the supervision and assistance of a prosthodontist. The case was completed by fabricating custom parts unique only to this patient. A sectional impression technique was used and a custom acrylic hinge base was created to obtain a maxillary mandibular record. A thorough space analysis of the patients limit oral aperture was conducted. A detailed diagnostic tooth set-up was performed on the diagnostic casts. A custom metal framework with a hinge and swinging arm was then designed and fabricated to fit the detailed tooth set up. This case report presents clinician with an alternative treatment in restoring masticatory function in patients with microstomia. More importantly, this report shows that a complex case of a patient with microstomia can be treated in an undergraduate dental clinic with the guidance of a faculty prosthodontist.
Intimate partner violence (IPV) is a severe problem with devastating health concerns. Current screening methods are inadequate to detect relationships between negative health effects and IPV. By constructing a network analysis based on health record data, it revealed trends of health effects of IPV which could improve future screening methods.

Intimate partner violence (IPV) is a serious problem that yields devastating negative health effects. The existing screening procedures used on IPV victims to find any other underlying negative health effects has been insufficient. Therefore, the potential certainty of relationships between IPV and negative health effects such as acute physical injury, sexual assault, and mental health issues are often unnoticed. To help improve screening and diagnosis of underlying negative health concerns associated with IPV victims, we decided to identify these health issues. By using de-identified electronic health record (HER) data provided from Explorys, we mined these records for health issues shown in domestic abuse (DA) and non-domestic abuse (NDA) victims and compared both by any noted health issues that were considered significant in the DA group. Between 14,315,140 non-DA records and 5,870 DA records, our analysis identified 2,429 significant terms. We then categorized all of the significant terms to 28 broad categories, which would set the basis of our network analysis to determine the strength of the relationships between categories. To achieve the network analysis, the frequency of each category were counted among the coded IPV-significant terms and then determining the frequency of co-occurrence of the categories. 208 pairs of categories were determined to have at least been assigned to one of the 2,429 terms. The results show acute conditions are strongly associated to cardiovascular, gastrointestinal, gynecological, and neurological conditions among victims. At the same time, acute injuries seem to remain isolated from other notable symptoms. In conclusion, network analysis of EHR data has uncovered trends in the negative health effects of IPV, and as such, would help to improve future screening and diagnostic analysis.
Quantitative histomorphometry (QH) is the process of computerized extraction of features from digitized slide images. Typically these features are used in machine learning classifiers to predict disease behavior and outcome. Successful robust classifiers require features that both discriminate between classes of interest and are stable across data from multiple sites. Feature stability may be compromised by variation in slide staining and scanning procedures. In this paper we present two new measures, Preparation-induced Instability Score (PI) and Latent Instability Score (LI), to quantify feature instability across and within datasets respectively. Dividing PI by LI gives a ratio for how often a feature is different between datasets from different sites versus what would be expected from random chance. Using this ratio we quantify feature vulnerability to preparation variation. Since our goal is to identify stable QH features we evaluate these features in a use case involving prostate cancer. Specifically we examine QH features which may predict biochemical recurrence from whole slide images. We present evidence from 80 patients across four sites that QH features can vary significantly. Using our method we found that five feature families (graph, shape, co-occurring gland tensors, gland sub-graphs, texture) were different between datasets in 19.3% to 55.6% of comparisons while the values expected due to random chance would be 4.1% to 4.4%. Our results appear to suggest that evaluation of QH features across multiple sites needs to be undertaken to assess robustness and class discriminability alone should not represent the benchmark for digital pathology feature selection.
In most clinical treatment approaches, a combination of androgen deprivation therapy (ADT) and ionizing radiation (IR) is used in order to improve prostate patients' overall survival probability. It is found that androgen receptor (AR) interacts with non-homologous end joining (NHEJ) pathway, a major double strand break (DSB) repair pathway. We have developed a mathematical model of the NHEJ pathway that is composed of a series of ordinary differential equations. The kinetic rate constants constitute the unknown parameters of the model and we have estimated these parameters using least square estimation. The data sets used in the parameter estimation were obtained from the literature and they were from both in vitro experiments as well as clinical data from prostate cancer patients. Both sets of data demonstrated the effects of AR on DSB repair by NHEJ. The clinical data show that the effect is through the first NHEJ protein complex that is recruited to DSB, Ku70/80. We have developed the models for IR treatment alone or in combination with ADT to determine which of these mechanisms can explain the behavior in both data sets simultaneously. We have carried out sensitivity analysis and identifiability tests on all the parameters from both models in order to determine the parameters that are reliably estimated. We have shown that when the rate constant for the initiation protein Ku70/80 is decreased to half in the IR+ADT case compared to the IR only case, the model outputs captured the observations in both experimental and clinical data. The rate constant for Ku70/80 is proved to be both sensitive and identifiable, indicating that the two-fold difference in the rate constants of IR only and IR+ADT cases is biologically relevant. Therefore, we conclude that when ADT is applied, AR significantly slows down the kinetic activity of Ku70/80, thus the DSB repair by NHEJ. The suppression of AR activity through ADT has the potential to enhance the IR treatment outcomes.
The NEI-sponsored Cornea Preservation Time Study (CPTS) is a randomized multi-center clinical trial that is measuring the potential impact of donor cornea preservation time (PT) on corneal transplant survival over a period of 3 years after Descemet stripping automated endothelial keratoplasty (DSAEK). The impetus of the study is that most surgeons do not use preserved donor corneal tissue in Optisol GS storage solution at 4oC beyond 7 days, even though the tissue is FDA approved up to 14 days. As a result, 1/3 of donors are being exported out of the USA in part because of this prejudice. It is being conducted at 23 eye banks (1330 donor corneas and 40 clinical sites (70 surgeons and 1090 recipients) around the USA. Eyes undergoing surgery for Fuchs endothelial corneal dystrophy or pseudophakic/aphakic corneal edema were randomized to receive donor corneas stored 7 days or 8 to 14 days. Donor and patient characteristics, tissue preparation and surgical parameters, recipient and donor corneal stroma clarity, central corneal thickness, IOP, complications, and central endothelial images were collected.

The study was conceived in 2007, protocol finalized with investigator meetings over 2 years, grant submitted in 2009 and not funded, resubmitted in 2010 and funded in 2011, first patients enrolled in 2012, last patient recruited in 2014, final followup in 2017 and primary papers and presentations the end of 2017.

To conduct a large, multi-center clinical trial, a number of collaborative resource components were retained. These include: 1) the Vision Research Coordinating Center at CWRU and UH responsible for coordination of all clinical sites to assure the protocol execution and compliance; 2) the Cornea Image Analysis Reading Center (CIARC) at CWRU and UH analyzing all the donor and clinical endothelial images to determine endothelial cell density; and the Data Management and Analysis Center at Jaeb Center for Health Research responsible for coordination of the eye banks, managing all data and analyses, and supporting the Data Safety and Management Committee.

The CPTS will increase understanding of factors related to DSAEK success and, if non-inferiority of longer PT is shown, will have great potential to extend the available pool of endothelial keratoplasty donors in the United States and around the world.
The main objective of this article is to illustrate awareness and knowledge about influenza viruses and have discussion about what could be improved in future research. Influenza are one of the contagious and epidemic disease that could evoke some complication and lead to death. Therefore, having awareness and discussing about future research for this disease would be critical for public health.

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The main objective of this article is to illustrate awareness and knowledge about influenza viruses and have discussion about what could be improved in future research. Influenza are one of the contagious and epidemic disease that could evoke some complication and lead to death. Therefore, having awareness and discussing about future research for this disease would be critical for public health.
There is high demand for efficient materials for applications such as photovoltaics and light emitting diodes. An emerging material called perovskite possesses desirable optical properties with the advantage of low cost. We use various structural and optical analyses to understand and further enhance these materials.

Abstract

Methyl ammonium lead halide perovskites have had a major impact on the field of photovoltaics within the past several years offering high performance solar cells with low cost materials and processing. However, all of these devices have been prepared using multi-crystalline films which are intrinsically riddled with grain boundaries. It has not been until recently that these perovskites could be produced as a single crystal. By preparing these materials as a single crystal, the amount of defects is reduced within the crystal which leads to better performing devices. With the formation of these single crystals, it is now feasible to use these materials for other applications such as light emitting diodes or as a solid state laser medium. To date most of the literature has focused on methods for producing perovskite single crystals and little is known about their optical properties. Upon photoexcitation, excited charge carriers are formed and the time that these carriers remain in the excited state is directly proportional to the device efficiency. In this work we synthesize methyl ammonium lead bromide (MAPbBr3) single crystals. These crystals are characterized structurally using x-ray diffraction and scanning electron microscopy. We then investigate the steady state optical properties using reflectance and emission measurements. It has been reported that multi-crystalline perovskite device performance can be enhanced by using a mixed halide precursor. We then investigate the effect of tuning these perovskites by preparing the MAPbBr3 single crystals prepared with an additional chloride precursor. To compare the performance of these crystals time-resolved emission measurements were used.
Magnetic particle imaging (MPI) is a new imaging technology that enables the direct mapping of magnetic nanoparticle tracers with no depth attenuation or background signal interference. Since the signal generation in MPI relies heavily on the magnetization reversal of the magnetic nanoparticle tracers, it is essential to tune the nanoparticle’s magnetic properties in order to achieve good MPI image resolution. To date, most studies have focused on optimizing spherical iron oxide nanoparticles in MPI applications. In this study, we have systematically investigated the effects of chemical doping and shape anisotropy on the MPI performance of the iron oxide nanoparticle tracers. Moreover, we fabricated a novel magnetic polymer composite by embedding iron oxide nanoparticles in ultra-high molecular weight polyethylene matrix to restrict nanoparticle Brownian relaxation, mimicking the magnetization reversal of nanoparticles in bound state during targeted imaging. The effects of zinc-dopant and increase in shape anisotropy were found to improve MPI signal of immobilized iron oxide nanoparticle tracers.
Abstract

The Hybrid Neuroprosthesis system (HNP) features an implantable Functional Electrical Stimulation (FES) system. While participants with the implanted system are capable of achieving coordinated gait relying solely on the implanted system, coordination is difficult and distances limited due to muscle fatigue and the open loop nature of the stimulation control. Similarly, unpowered orthotics and powered exoskeletons have been used to achieve gait in people with SCI.

The Hybrid approach aims to combine the advantages of both stimulation and exoskeletons. The implanted FES system is capable of delivering large torque impulses very quickly, while the exoskeleton provides support when necessary, such as when quietly standing. Additionally, the exoskeleton carries enough sensors to provide gait state feedback to the FES system.
The adhesive and deforming characteristics of red blood cells play a critical role in vascular occlusions that lead to life-threatening crises in sickle cell disease (SCD). The altered properties of sickle erythrocytes due to the presence of homozygous sickle hemoglobin reduces cellular deformability and increases cell adhesion onto (sub)-endothelium matrix proteins such as Laminin (LN) and Fibronectin (FN). This sophisticated dynamic process takes place within a wide range of shear rates indigenous to different types of microvasculature. We have designed and fabricated a physiologically relevant microfluidic device which creates a variable shear gradient along the flow direction in order to investigate the adhesion of sickle Red Blood Cells (sRBC) under continuously transitioning shear rates. Utilizing our shear-variable Hele-Shaw microdevice, we simulated the shear specific adhesion of sickle cells of different deformability levels to both LN and FN and reported two new parameters, namely Shear Dependent Adhesion Rate (SDAR) and normalized Shear Dependent Adhesion Rate (nSDAR). We observed higher SDAR values in RBC-LN interaction particularly for deformable type of sRBCs suggesting a potential association between cell deformability and shear dependent adhesion. We further reported normalized SDAR numbers for each experimental group (i.e., deformable cells, non-deformable cells), which indicated that the non-deformable sRBCs attached to FN were the least shear-dependent group. Moreover, those cells required significantly higher estimated shear rates than physiological conditions to be entirely removed from the channel walls.
Breast cancer is a heterogeneous disease associated with distinct clinical outcomes. Extremely deleterious is the brain metastasis associated with the triple negative breast cancer (TNBC) subtypes. A lack of targeted therapy against TNBCs makes understanding their epigenomic changes an important endeavor potentially elucidating treatments that may prevent their metastasis.

Abstract

Breast cancer will affect 1 in 8 women throughout their lifetime. It can be divided into four major subtypes based upon receptor markers: luminal A, luminal B, Her2+ and triple negative. While women afflicted with luminal A, luminal B or Her2+ breast cancer can be treated with breast cancer subtype-specific therapies, there is currently no targeted therapy for triple negative breast cancer (TNBC) which ultimately comprises 14-20% of all breast cancers. Hence, there is a serious need to increase our understanding of the genesis of these breast cancers. A way to expedite our understanding is through elucidating initial epigenetic modifications that lead to altered transcriptomes in breast cancer. I propose building a deeper understanding of the diverse populations within the breast cancer, and TNBC subtype specifically, by characterizing differences in the super-enhancer epigenetic landscapes of breast cancer subtypes. Super-enhancers are large continuous clusters of typical enhancer sequences within DNA that have the ability to activate and sustain the expression of cell identity genes via interactions with transcription factors, co-factors, and epigenetic histone modifiers. While it is possible to identify changes in the global transcriptomes of breast cancer, discovering the associated changes in the epigenome would reveal the underlying alterations that ultimately control the genome as cells progress from normal to malignant phenotypes. The super-enhancer landscape has not yet been defined for the diverse triple negative breast cancer subtypes, therefore discovering these specialty enhancers will elucidate epigenetic pathways required for the development, maintenance, and potential therapeutic targeting of the divergent cancer phenotypes that are collectively known as breast cancer.
### Abstract

Microalgae have gained attention as a feedstock for biofuel production, given their ability to efficiently convert sunlight and inorganic carbon into lipids that are readily converted into biodiesel (Menetrez, M.Y., 2012). One proposal for decreasing the fertilizer and water required for algal cultivation is growing algae in wastewater-fed open ponds (Kim, B.-H. et al., 2014). This platform could also include nutrient modulation to increase the lipid content of algae before harvesting, as lipid content increases in many algae under nutrient limitation. However, this approach would prove difficult for the cultivation of a single species of algae, given competition from outside organisms and pathogens. For this reason, we examined the effects of nutrient depletion cycles on the metabolic profiles and ecology of a mixed algal-microbial consortia. Bioreactors inoculated with natural algal samples were fed weekly with synthetic wastewater and maintained at pH 7.5 and pH 9 for four weeks. Reactors operated at pH 7.5 showed an overall decrease in lipid content over the study period, with a fatty acid profile consisting primarily of myristic, palmitic, vaccenic, linoleic, and alpha-linoleic acid, but with an increase in palmitoleic acid content over time. Reactors operated at pH 9 showed little change in total lipid content over the study period, with a fatty acid composition of primarily palmitic and alpha-linoleic fatty acids initially, followed by a decrease in alpha-linoleic acid content coupled with an increase in linoleic and vaccenic acid over time. The starch composition of algae in all reactors was stable over time, with the exception of an initial increase in the pH 7.5 reactors. Finally, from microscopic observation, pH 7.5 reactors transitioned from largely Synedra, Scenedesmus, and Chaetopeltis algae to Dicellula and Glaucocystis. Meanwhile, pH 9 reactors transitioned from primarily Synechocystis to a mix of Synechocystis, Scenedesmus, and Oscillatoria.
Introduction: Urticaria is a common disorder, with a prevalence of 20% in the general population. A typical urticarial lesion is an intensely pruritic, erythematous plaque. Urticaria is sometimes accompanied by angioedema. Some triggers can be food ingestion, drug, insect bite, infection or unknown cause. Identifying the reason for urticaria helps avoiding further disease in the future by avoiding the cause.

Objective: Case report of a patient with ACE-I induced urticarial reaction, along with journal article review of similar case studies with ACE-I urticarial reactions.

Case: A 61-year-old male with history of shellfish allergy, HTN, and CKD as medical issues who presented with multiple areas of swelling that had been present for about 2 months but worsened about a week prior to admission. On physical exam patient had a large wheal about 10x7cm on the right shoulder blade, no erythema, not tender to touch, and no other signs of infection etiology. Pt also had swelling in his right hand with history of swelling in his lips prior to admission. The workup included allergy testing and screening for autoimmune diseases. Many drugs have been known to cause Urticaria with angioedema. Ace-I in particular are known to have such a reaction together. It was first reported in the early 1980s that ACE inhibitors can cause angioedema, but it is not uncommon to see urticaria with these drugs. Most instances of drug induced angioedema with urticaria are thought to be mediated by immunological mechanisms. Uterica reaction plus angioedema have been documented to resolved within 2-6 days after removal of the Ace-I.

Results: Our patient had complete resolution of urticarial reaction and angioedema with discontinuation of ACE-I.

Conclusions: Discontinuing of the offending agent in most cases eradicated urticarial lesions and further episodes of drug related urticarial reactions.
Abstract

Monitoring and predicting chronic wound healing is an important, challenging task. The healing process varies both between individuals and between wounds. Wound closure may be interrupted by intermittent abnormalities or show a prolonged healing trend. Efficient prediction and monitoring can help health providers to decide personalized treatment and invention options. In our previous work, we developed a personalized prediction of chronic wound healing model using 3D digital measurement. Here, we translate and generalize our work toward clinical translation.

We developed a personalized adaptive healing monitoring tool pMor() to both predict and monitor the healing process of an individual wound. In this presentation, we showcase an app via an interactive visualizing tool —Shiny, implemented in our own new R package, to facilitate clinical application of statistical models in wound healing.
Hypertension Self-management in Saudi Arabia

Abstract

Background and purpose of the study. Hypertension affects about 10% of the Saudi population. An increased prevalence of hypertension and its related health problems still exists in the Saudi adult population. Considerable data indicate that hypertension control and self-management are far from adequate in Saudi Arabia. Research studies regarding health literacy and patient activation in chronic disease management is a needed method, aiming at understanding ways to motivate patients to improve their self-management behaviors of chronic diseases, including diabetes and hypertension. Thus, the purpose of this study is to address the significance of disease specific knowledge, health literacy, and patient activation in improving hypertension self-management behaviors among Saudi adults.

Theoretical framework. The study is guided by the framework of the Individual and Family Self-management Theory. By drawing on this theory, it is proposed that attaining adequate disease knowledge and health literacy assists patients in advancing their activation to higher levels, leading to long engagement in hypertension self-management behaviors.

Methods. A correlational descriptive study will be conducted. The study participants will be 98 adult patients with a clinical diagnosis of hypertension from five different major primary healthcare centers in Riyadh, Saudi Arabia. Hypertension self-management knowledge will be measured with the Hypertension Evaluation of Lifestyle and Management, the short version of the Test of the Functional Health Literacy for Adults will measure health literacy levels of individuals, the patient activation will be measured with the 13-item Patient Activation Measure, and hypertension self-management behaviors will be measured with the Hill-Bone compliance to high blood pressure therapy scale. Data will be collected by distributed surveys at the date of consent. Flexible schedules will be arranged with the participants at primary healthcare centers to receive a letter of informed consent and survey instruments. Instructions will be given to the participants to help them answer these questionnaires appropriately.
Deletion of Glutaredoxin GLRX-22 Affects the Dopaminergic Neurons in Caenorhabditis Elegans

Abstract

Parkinson’s disease (PD) is the second most common age-related neurodegenerative disorder characterized by profound and selective loss of dopaminergic (DA) neurons in the substantia nigra of the midbrain. One prominent contributor to PD pathogenesis is oxidative stress. Increased oxidative stress leads to oxidative modifications of proteins; a prevalent form of which involves the formation of a mixed disulfide bond between glutathione (GSH) and a reactive cysteine (glutathionylation). Glutaredoxin (Grx1 and Grx2) is an antioxidant enzyme that removes this modification and helps to restore redox homeostasis. There are two isoforms of Grx2 that are present in the Caenorhabditis elegans (C.elegans), Glrx-21 and Glrx-22. Using C.elegans with Glrx-22 genetically ablated, we examined the effects of glutaredoxin in the dopaminergic survival in vivo. Results and Discussion: Our previous studies have found that 730xVZ222 (glrx-22 knockout; partial deletion in exon 2 and complete deletion in exon 3) worms demonstrated a wild type phenotype. Furthermore, genetic mating between 730 and VZ222 showed that wild type gene is dominant while VZ222 is recessive. Our ongoing experiments will use glrx-22 RNAi to examine the function of glrx-22? (undeleted exon 1 to partial undeleted exon 2) and the cause of its toxicity to the dopaminergic neurons, and identify if Grx2 affects other neuronal cells (i.e. touch receptor neuron; mec-7 and GABAergic neuron; unc-47). Conclusion: In summary, our findings indicate that glutaredoxin is neuroprotective and further mechanistic investigation may provide useful insights regarding the development of therapeutic strategies for the treatment of age-related disorders including PD.
Uncovering Wnt/Dishevelled-Mediated Molecular Mechanisms Controlling Differentiation and Early Development

Embryonic stem cells derived from an embryonic lethal mouse model are used to study epigenetic and transcriptional changes mediated by the canonical and non-canonical Wnt pathways. How these Wnt pathways are interconnected is not well understood. This work may have implications in better understanding development and cancer.

Wnt signaling pathways are evolutionarily conserved and are required for early cell fate determination and embryo development. The canonical Wnt/?-catenin and non-canonical Wnt/PCP pathways share critical components, like the Dishevelled proteins, to mediate intracellular signaling. Proper regulation of the Wnt signaling pathways through the Dvl proteins is crucial for early embryonic differentiation and development, as inactivating mutations in the Dvl genes has been shown to lead to developmental abnormalities and embryonic lethality. Our lab previously discovered that mice with homozygous deletions in all three of the Dvl genes (Dvl1, Dvl2, and Dvl3) are peri-implantation lethal due to an inability to undergo gastrulation and form mesoderm. However, it is not clear which Wnt pathway is mostly responsible for the gastrulation defects in the Dvl triple knockout embryos. To study the gastrulation defects, we have generated a conditional Dvl triple mutant mouse model with the goal of producing Dvl1-/-; Dvl2flox/flox; Dvl3-/-; CreER-TM blastocysts to generate mouse embryonic stem cells (mESCs) that are representative of the pre-implantation embryo. Using this Dvl triple mutant mESC model, we can induce Dvl2 deletion in vitro by tamoxifen treatment to obtain a complete triple Dvl null background and model the effects of Wnt signaling ablation within the developmental window preceding gastrulation in order to better understand the cause of the gastrulation defects in the Dvl triple null embryos. Moreover, we have a scalable system and a homogenous population of cells to perform genome-wide analyses, such as ChIP-seq and RNA-seq, to determine the epigenetic and transcriptomic changes that occur during the pre-gastrulation stages of development. We would also be able to study the regulation and crosstalk of the Wnt pathways during early embryonic development and differentiation, which would otherwise be challenging with gastrulation defective triple Dvl null embryos.
We hypothesized that epilepsy affects the activity of the autonomic nervous system even in the absence of seizures, which should manifest as differences in heart rate variability (HRV) and cardiac cycle. To test this hypothesis, we investigated electrocardiogram (ECG) traces of 91 children and adolescents with generalized epilepsy and 25 neurologically normal controls during 30 minutes of stage 2 sleep with interictal or normal EEG. Mean heart rate (HR) and high-frequency HRV corresponding to respiratory sinus arrhythmia (RSA) were quantified and compared. Blood pressures (BP) from physical exams of all subjects were also collected and analyzed. RSA was on average significantly stronger in patients with epilepsy, while their mean HR was significantly lower after adjusting for age, body mass index, and gender, consistent with increased parasympathetic tone in these patients. In contrast, diastolic (and systolic) blood pressure at rest was not significantly different, indicating that the sympathetic tone is similar. Remarkably, five additional subjects initially diagnosed as neurologically normal, but with enhanced RSA and lower HR, eventually developed epilepsy, suggesting that increased parasympathetic tone precedes the onset of epilepsy in children. ECG waveforms in epilepsy also displayed significantly longer TP intervals (ventricular diastole) relative to the RR interval. The relative TP interval correlated positively with RSA and negatively with HR, suggesting that these parameters are linked through a common mechanism, which we discuss. Altogether, our results provide evidence for imbalanced autonomic function in generalized epilepsy, which may be a key contributing factor to sudden unexpected death in epilepsy (SUDEP).
Alkylating agents such as Nitrogen Mustard (NM) causes severe blistering of skin and systemic toxicity from cutaneous exposure. Our previous work showed that this due to a two hit mechanism in response to cutaneous NM exposure. The first hit is a result of acute toxicity whereas and the second hit occurs upon infiltration of activated macrophages. A single intraperitoneal injection of 5ng of 25-hydroxyvitamin D3 (25(OH)D) administered 1hr after NM exposure is capable of rescuing mice from this activated immune response. In this study we developed a panel of antibodies to analyze mouse bone marrow health using flow cytometry focusing on macrophages. Using this panel we show that NM-exposed mice with and without treatment exhibit no difference in their overall bone marrow counts or flow cytometry profile on days 1 and 2 post exposure, thus presenting an opportunity for intervention. We found that 5ng 25(OH)D administered up to 24hr post NM exposure is able to facilitate 100% recovery in mice. In contrast failure to intervene before 48hr proved too late at and beyond which there was 60% death between days 6 to 12. Since 48hr seemed to be the critical time at which 25(OH)D had no effect on exposed animals, we tested the effect of two consecutive doses of 5 ng of 25(OH)D at 48 and 72hr post NM exposure. This approach showed improved efficacy with reduction of lesion sizes and 100% recovery from mortality. Daily analysis of the bone marrow especially on day 6 showed significantly different total bone marrow counts and phenotypes between 25(OH)D treated and untreated mice. Without intervention NM exposed mice presented significantly increased total macrophage percentage that were predominantly of the activated macrophages (M1) phenotype compared to the macrophages in mice treated with 25(OH)D. Our study illustrates the importance of timely treatment for dermal NM exposure and provides a mechanism of systemic toxicity that may play a major role in its morbidity.
The Department of Public Advocacy provides protection and advocacy services throughout the Commonwealth of Kentucky. The goal of the organization is to provide each client with high quality services through an effective delivery system, which ensures a defender staff dedicated to the interests of their clients and the improvement of the criminal justice system. This educational internship gave me hands-on experience and expanded my knowledge on how the law and the court system affects individual’s lives. I accompanied attorneys to their jail visits, interviewed clients and witnesses, conducted legal research, drafted memos, and assisted in jury trials. After completing the internship, I have learned that attorneys in this position have to present their clients’ cases like a story in order to persuade the jury that their client is innocent. Additionally, although the criminal justice system is supposed to be fair to all individuals, this is not always the case. Many people of color receive harsher punishment for equal or lesser crimes than do Whites. Prisons are assembled like businesses and many of them focus on keeping inmates there to make a profit than to rehabilitate offenders.

This research is significant because it illuminates the imperfections of the criminal justice system. It reveals the institutional racism that exists within the United States to punish communities of color more for the same crimes Whites commit. Reform of the criminal justice system is needed to make sure offenders receive justified punishment across all races.
This study summarizes the room temperature fracture and fatigue crack growth behavior of a second generation gamma titanium aluminide Ti-48Al-2Nb-2Cr (Ti4822) and a third generation Ti-43Al-4Nb-1Mo (Ti4341) used in high performance gas turbine engine low pressure turbines blades. Bend bar samples were machined from as-cast ingot billets and tested in the longitudinal and transverse directions in order to determine the fracture toughness and fatigue crack growth rate at room temperature in air. While the effects of alloying additions in the second vs third generation titanium aluminides on the toughness and fatigue crack growth have been published for different load ratios for 4822, the present work extends to as-cast 4341. In the fatigue crack growth tests, the threshold was determined in addition to the Paris slope and overload toughness, Kc. Optical and SEM examinations were used to determine the microstructure, fracture path and topography in order to enable comparisons between the two systems.
53BP1 is a conserved checkpoint protein that plays an important role in DNA double strand break repair. 53BP1 is a nucleus protein that interacts with Lamin A. UbcH7 is an E2 ubiquitin-conjugating enzyme mediating degradation of many proteins. Previously we reported that Ubch7 regulated the protein stability of 53BP1. However, the molecular mechanism is still unclear. Here, we reported a significant increase of 53BP1, Chk1 and Lamin A protein in Ubch7 knockdown stable cells. Interestingly, we also observed that abnormal Lamin A causes significant nuclear shape alterations in Ubch7 knockdown cells. 53BP1 is degraded after treatment with camptothecin (CPT); however, both proteasome inhibitor MG132 and the Cathepsin-L (CTSL) cysteine protease inhibitor blocked the degradation of 53BP1 by CPT. CPT-induced 53BP1 degradation occurs generally in soluble (cytosolic and nuclear) cellular fraction, and the degradation seems to be due to the increased amount of the active CTSL form. We found that depletion of Ubch7 in A549 cells induced downregulation of CTSL both at protein and mRNA level. On the other hand, 53BP1 is accumulated in nuclear matrix fraction in Ubch7-depleted cells after treatment with CPT, in which the accumulation of 53BP1 seems to be due to strong interaction with Lamin A. These results suggest that 53BP1 is degraded by both ubiquitin–proteasome system and the endosomal/lysosomal pathway. CTSL, a protease of the endosomal/lysosomal pathway, is regulated by Ubch7. Moreover, Ubch7 regulates the structure of nucleus through the increase in the level of Lamin A, which contributes to the 53BP1 stability.
The SOM Light Microscopy Core Facility on the Case Western campus provide shared resources and offer a wide range of services to the research community. Our facilities are committed to enhancing and expanding collaborative capabilities of research in the 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 cores 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, 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 image quantification, co-localization analysis, deconvolution, and 3D reconstruction. We are sure 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!
Abstract

Background: This study will assess the impact that ADHD, mental health comorbidities, and trauma symptoms have on youth involved in the juvenile justice system. The relationships among ADHD, juvenile offending, and lower levels of functioning have been supported by multiple studies. However, it is difficult to discern if these negative outcomes are attributable to ADHD alone or other co-occurring factors like comorbid mental health issues, or trauma exposure.

Method: Data for this study were drawn from the Behavioral Health Juvenile Justice Initiative (BHJJ), which is a multi-county juvenile justice diversion program in Ohio. Youth between 10 and 18 years old are screened for mental and behavioral health issues at intake and are diverted into community based mental health facilities for treatment.

Results: The sample consists of 985 youth with an average age at intake of 15.58 years. The sample is slightly more male (62.3%), and non-white (51.7%). Most of the sample was assessed as either being at moderate risk (55.8%) for recidivism. 21.6% of the sample was diagnosed with an internalizing disorder, 45.4% was diagnosed with an externalizing disorder, and 32.9% was diagnosed with both an internalizing and externalizing disorder. Over one-third (36.9%) of the youth in the sample was diagnosed with ADHD.

Findings suggest that ADHD is a significant predictor of lower levels of functioning in youth with an externalizing disorder only. Parent hopefulness is a significant predictor of higher functioning across all mental health classifications.

Conclusions: Findings suggest that the effects of ADHD are more severe when it co-occurs with an externalizing disorder. Parental engagement is also important when working with juvenile justice involved youth. Further, more research is needed to determine predictors of functioning for youth with internalizing disorders.
Abstract

Ultraviolet light played a key role in the chemistry of organic molecules on early Earth. The energy associated with the ultraviolet light is high enough to electronically energize, break chemical bonds, and ionize organic molecules. These effects can degrade biologically-relevant molecules, creating environmental stress that can impede abiogenesis. Besides, biogenesis also took place long before the formation of the stratospheric ozone layer, which currently filters out the most dangerous ultraviolet components of sunlight, and thus under conditions of extremely intense high-energy ultraviolet radiation. According to the widely accepted RNA World theory, the canonical nucleobases evolved from a complex mixture of organic molecules on early Earth, the so-called “prebiotic soup”. Hence, it is important to scrutinize the stability of putative ancestral RNA candidates toward ultraviolet radiation in order to support their putative prebiotic involvement and, ultimately, to understand the molecular origins of life. In our laboratory, we use spectroscopic techniques to monitor the electronic relaxation pathways and molecular integrity of promising ancestral RNA candidates when exposed to ultraviolet radiation. In this presentation, we will show our most recent and exciting results and will discuss the potential implications to the molecular evolution of the RNA building blocks.

The authors acknowledge the CAREER program of the National Science Foundation (Grant No. CHE-1255084) for financial support.
Robot Assisted Minimally Invasive Surgery (RAMIS) has been successfully used in many surgical procedures and gained favor among patients for the benefits of smaller incisions and faster recovery. However, these applications are still limited to direct teleoperation by surgeons and are typically slow due to the confined workspace for dexterity, poor endoscopic vision, and insufficient sensing. Recently autonomous robotic surgery has drawn heavy research to improve RAMIS procedures. Our previous research has successfully performed low level suturing tasks such as needle driving, suture pulling, and knot tying by robots automatically. By adopting advanced sensing techniques for visual and tactile feedback, as well as new skills for needle grasping and suture handling, we are able to perform real time suture tracking, optimized needle driving, and fast knot tying. All of these skills are crucial to autonomous robotic surgery.
Subsurface Mapping of the Point Pleasant Formation, Ohio

The Point Pleasant Formation has great economic impact in Ohio, and knowing its subsurface structure and mineralogy is important for safe usage of the formation, whether it is carbon capture and storage or hydrocarbon extraction.

Ordovician
Ohio
Stratigraphy
Point Pleasant Formation
Geophysical Logs

The Point Pleasant Formation in Ohio consists of Ordovician calcareous shale, siltstone and carbonate that interbed the underlying Trenton and Lexington carbonate platforms and the overlying Kope Formation. It varies in depth from 500 ft in western Ohio to more than 7,500 ft in eastern Ohio. The Point Pleasant has several important functions, including being a source rock for hydrocarbon production in eastern Ohio and further into the Appalachian Basin, and part of a cap rock system for carbon capture and storage in western Ohio, which is one mitigation strategy to help reduce Ohio's carbon footprint. Carbon capture and storage needs to know the thickness, extent and mineralogy of the cap rock in order to assess its capability to keep carbon dioxide in the subsurface indefinitely. Subsurface mapping using well logs, coupled with rock cores and samples, is the most effective method to decipher the extent of the formation, observe the interactions of units amongst each other, and extrapolate mineralogy across the area. Here, we focused on the Point Pleasant Formation in Western Ohio, and mapped several subsections based upon rock core mineralogy of the unit across the region.
**Elevator Speech**

We examined the effectiveness of medication-assisted treatment (MAT) in a drug court for people with opioid addictions. We did qualitative focus groups with drug court staff. Benefits of MAT includes mental clarity and challenges of MAT includes discontinuation of use as a risk factor for relapse.

**Key Words**
- medication-assisted treatment (MAT)
- opioid
- drug courts
- drug addiction
- qualitative analysis

**Abstract**

**Background:**
The use of heroin and opioid pain relievers has significantly increased in Ohio over the past 15 years. To address the problem, Addiction Treatment Pilot Program (ATPP), a drug court program, was funded by Ohio Department of Mental Health and Addiction Services. ATPP is the collaborative program that includes judicial supervision, substance abuse treatment, and medication-assisted treatment (MAT) for opioid addiction. There are limited qualitative studies that address how MAT works for people who suffer from opioid addiction in drug courts.

**Method:**
A total of 54 drug court staff members were recruited by the nine ATPP courts in Ohio. In-person focus group interviews and phone interviews were conducted. To prepare for data analysis, two to three evaluation staff members took notes of the focus group and phone interviews. Atlas.ti was used to analyze the data and identified themes that are constant across participants.

**Results:**
Two themes emerged in the use of MAT: benefits and challenges. Participants identified that MAT improves retention in treatment, mental clarity, and emotion regulation, as well as it is more accessible and convenient. The challenges of MAT were also reported: side effects, discontinuation by clients’ status (e.g., pregnancy), alcohol use, and other drug use. There were three other themes related to the overall ATPP: suggestions for future drug courts, benefits, and challenges of ATPP.

**Conclusions:**
Data supported that MAT contributed to reduction in drug use and to impacts on client symptoms directly, although there are some limitations. Staff emphasized cooperation with other service providers to produce diverse services with MAT. Diverse treatment services must include mental health, trauma, employment, and childcare.
Quality control during gene expression is an essential process that ensures genetic information is properly conveyed in the cell, and failure to detect and eliminate mistakes is detrimental to the cell. We are interested in how the cell is able to distinguish between normal and faulty intermediates and how it then targets the nonfunctional molecules to rapid disposal.

**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 Upf-frameshift 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.
Evaluating heat transfer of diamond coatings for application in implantable devices with MRI compatibility

Patients with implantable devices, such as pacemakers and DBS electrodes are unable to benefit from MRI diagnostic techniques. RF fields from an MRI scan produce tissue damaging heat via magnetic induction of metallic components within the implants. The present research investigates the heat transfer characteristics of diamond coatings on metal wires similar to those in medical implants, the diamond coating as a possible solution due to its high thermal conductivity and negative magnetic susceptibility. Through simulation and experiment, a model has been constructed to predict how heat dissipates in a diamond-coated wire system. These preliminary data will help in design of diamond coatings as part of electrode devices, to maximize heat dissipation and thus hopefully lead to MRI compatible electrode systems.
Coercivity Model for (Co, Ni)-based Soft Nanocomposite Magnets

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(Co, Ni)-based nanocrystalline alloys (Co1-xNi)88Zr7B4Cu1 have shown promise with coercivities less than 50 A/m, which could be used in energy-related applications such as high and low frequency transformers, AC machines, motors, generators, and 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-xNi)88Zr7B4Cu1 with 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, following the same procedure previously used[2]. Room temperature magnetic hysteresis and temperature dependent magnetization have been studied. Coercivity data from this work will be used to validate our proposed coercivity model.

References

Efficient Processing of Network Proximity Queries via Chebyshev Acceleration

Network proximity is at the heart of a large class of network analytic and information retrieval techniques, including node/edge rankings, network alignment, and random walk based proximity queries, among many others. Owing to its importance, significant effort has been devoted to accelerating iterative processes underlying network proximity computations. These techniques rely on numerical properties of power iterations, as well as structural properties of the networks to reduce operation counts. In this paper, we present an alternate approach to acceleration of network proximity queries using Chebyshev polynomials. We show that our approach, called Chopper, yields asymptotically faster convergence in theory, and significantly reduced convergence times in practice. We also show that other existing acceleration techniques can be used in conjunction with Chopper to further reduce operation counts. Using a number of large real-world networks, and top-k proximity queries as the benchmark problem, we show that Chopper outperforms existing methods for wide ranges of parameter values. When integrated with existing methods, Chopper yields two-fold reduction in performance over the state of the art for networks with millions of nodes and edges.
Team Decisionmaking (TDM) is utilized to make the best decision for children regarding potential removal from the home, reunification, or adoption. Attendance of all related participants is encouraged so their voices contribute to the decision. While previous research demonstrates positive relationships between greater meeting attendance and positive outcomes, little is known about the relationship between family attendance and adherence to TDM practices.

Methods
Research team developed and pilot tested a 32-item self-report questionnaire to assess adherence to TDM practices. 395 questionnaires and 52 meeting recordings were collected from 101 TDM meetings at the Division of Children and Family Services. Meeting recordings were analyzed by coders for adherence to TDM practices. Spearman correlations were computed to examine the relationship between family attendance and adherence to TDM.

Results
Higher family attendance rate correlated with greater adherence to TDM practices. The more family members in attendance, the more facilitators encouraged participants’ discussions regarding safety concerns ($r = .315$), strengths and supports ($r = .334$), needs and concerns ($r = .349$), and evaluation of each idea ($r = .313$). Facilitators’ use of white boards to record the meeting process and summarization of team decisions also occurred more extensively. In summary, greater attendance of family members improved adherence to TDM practices.

Conclusions
Family attendance was associated with greater adherence to key TDM practices related to family engagement and understanding of the TDM meeting process. Our findings suggest that greater attendance of family members at meetings may improve TDM adherence, improving decision outcomes for children and families involved with the child welfare system. Therefore, greater efforts should be made toward encouraging active participation of family members in TDM meetings.
Abstract

The biliary network is a complex series of highly branched ducts. It is composed of cholangiocytes, which are specialized epithelial cells. This network is vital for bile transport and abnormalities in its structure has been implicated in liver disease. Yet, there is missing methodology to quantify defects in the biliary branching pattern that can arise from disease. Through the assistance of Cleveland Clinic’s Imaging Core department, the Sakaguchi laboratory has developed computer algorithms to quantify the morphogenesis of branched networks. My primary participation within the project involves working with the liver analysis program and density analysis program to analyze the laboratory’s data.

Biliary atresia is a particular liver disease that is characterized by the thinning or occlusion of biliary ducts. Inhibition of cyclin-dependent kinase 5 (CDK5) in the cholangiocytes of zebrafish lead to similar phenotypes as expressed in infants afflicted by biliary atresia. This leads us to believe that we may gain insight into the molecular pathology of biliary atresia through zebrafish modeling. Through CDK5 knockout of zebrafish, the data suggests that CDK5 regulates the conserved Pak1-Limk1-Cofilin kinase-signaling cascade[1] for proper cellular projection formation, ultimately leading to healthy morphogenesis of the biliary network. The goal of the research is to eventually explore novel therapeutic approaches for biliary atresia.
An attempt to mimic Manduca sexta forewings was recently made for the purpose of furthering the development of Flapping Wing Micro Air Vehicles (FWMAVs). While the comparisons between the artificial wings and the real wings detailed in the research showed successful reproduction of Manduca sexta forewings only a select few metrics were used to draw this conclusion. In addition, the experiments that were conducted to make the comparisons were newly designed and thus require verification through repetition and the use of a control specimen. By refining the experiments and expanding upon the existing metrics, this work hopes to uncover areas in which the current engineered forewings can be improved. At this point, new materials and alternative fabrication techniques will be investigated leading to higher precision and more accuracy in the resultant wings. Furthermore, the flapping mechanism used to drive the wings for testing purposes can also be studied. The existing flapping mechanism accurately replicates the stroke amplitude, stroke plane angle, interwing angle, and flapping frequency of M. sexta. However, this work presents additional characteristics that could be replicated such as downstroke angle of attack, upstroke angle of attack, and wing position during pronation and supination. As the flapping mechanism is adjusted to generate wing tip trajectories that more closely resemble the hawk moth, reduction in volume and mass of the mechanism is also attempted. This process, which is similar to the process applied to the forewings, is akin to mimicking the animal’s thorax. Once the forewings and thorax have been replicated, other components such as the abdomen, legs, and hindwings and their relevance to the animal’s flight abilities are to be explored. This work is intended to advance the understanding of M. sexta and its potential role as an inspiration for FWMAVs.
### Abstract

The time-varying flight control behavior of the Manduca Sexta, a type of moth, is replicated using Tapped Delay Feed-forward Neural Networks and Echo-state Neural Networks. Research at the biologically inspired robotics laboratory at Case Western Reserve University is underway to create a Flapping-Wing Micro Air Vehicle (MAV) based on the Manduca Sexta. One of the current limitations in replication of winged flight by Micro Air Vehicles are the controls. Said limitations cause MAV to be ill equipped to function like their biological counterparts. Current developments in the hardware of MAV robots have led to the creation of Flapping-Wing MAV. However developing a controller for a Flapping-Wing MAV through classical methods is likely intractable. This problem may be solved through learning approaches based on data experimentally taken from the manduca sexta. After training the two networks on control input and output pairs, it is demonstrated that learning methods may present a practical solution to this problem.
Patients with IBD are at increased risk of developing colorectal cancer but the pathogenic mechanisms remain unclear.
Increasing evidence suggests that colonic dysplasia and colitis-associated cancer (CAC) are the results of repeated cycles of epithelial cell injury and repair in the context of chronic production of inflammatory cytokines. Several mouse models of CAC have been proposed including mutant mice and combination of dextran sulfate sodium (DSS) with the genotoxic agents azoxymethane (AOM) and 1,2-dymethylhydrazine (DHM). One of the problems is that these models rely on genetic mutations that are absent in patients with IBD and challenge normal mice lacking the genetic predisposition, immunological dysfunction and dysbiosis characteristic of IBD. We have previously shown that SAMP1/YitFc (SAMP) mice develop a progressive CD-like ileitis in the absence of spontaneous colitis.

The aim of this study was to test the effects of DSS-AOM administration in SAMP mice as a novel model of CAC. SAMP mice were given a single dose of AOM (7,4mg/kg) followed by two cycles of 3% DSS for 7 days in drinking water. Parental AKR/J mice were used as controls. Mice were monitored during treatment in order to observe presence of clinical features of colitis and tumor development. Colonoscopy was a useful tool that allowed to follow the effect of AOM-DSS treatment at different time points.

SAMP mice developed significant higher number of polyps after AOM-DSS treatment compared to AKR control mice as well as increased incidence of high-grade dysplasia. Inflammation index scores of colitis and ileitis were significantly elevated in SAMP mice compared to AKR controls. Production of cytokines such as IFN-?, TNF-? , IL10 from MLN cells were increased in SAMP mice compared to AKR; in contrast IL6 production was lower in SAMP mice compared to AKR. Production of pro-inflammatory cytokines IFN-?, TNF-? from colon tissue culture resulted strongly expressed in SAMP as well. Furthermore cytokine profiles evaluated in colon tissues by qRT-PCR revealed significant production of Th1 and Th17 cytokines in SAMP mice. Several markers such as ?-catenin, Cyclin D1, MMP7, COX2, c-Myc were significantly elevated in SAMP mice compared to AKR.

Interestingly, treatment with only repeated cycles of 3% DSS in the absence of AOM showed presence of high grade dysplasia and tubular adenomas SAMP mice and a normal phenotype in AKR mice. Taken together, our results demonstrate increase colonic inflammation and tumorigenesis in SAMP mice with CD-like ileitis. This
Background: Fn14 is a cytokine receptor with important functions in normal and pathologic tissue remodeling regulated by its ligand TWEAK. TWEAK/Fn14 interactions regulate apoptosis and cell proliferation. Our previous data showed that Fn14 KO mice develop colorectal adenocarcinoma (CAC) with DSS administration without injection of carcinogen like azoxymethane (AOM) (Gastroenterology 5.146 (2014): S-825. However, the mechanism(s) of Fn14 regulating intestinal injury and CAC have not been fully elucidated. The aim of this study was to determine the role of Fn14 in these processes.

Methods: Colitis and CAC were studied in Fn14 KO and WT mice through endoscopy, histology, TUNEL-assay, cytokine ELISA, BrdU assay, bone marrow (BM) chimera and percent weight loss analyses. Colitis and tumors were induced by administration of 3% DSS only in drinking water for 7 days or by injection of azoxymethane (AOM) prior DSS administration.

Results: Fn14 KO mice showed increased levels of TNF-?, and IFN-? in stimulated MLN cells compared to WT littermates, at day 7 of DSS treatment. Fn14 KO mice transplanted with BM derived from Fn14 KO mice had more severe colitis than WT mice transplanted with BM derived from WT mice. Mice deficient in Fn14 in either the hematopoietic or non- hematopoietic compartment were protected at day 8 after colitis induction; Fn14 KO BM->Fn14 KO mice lost more weight than the other 3 groups at day 8. During the recovery phase, Fn14 KO mice developed colonic tumors with severe dysplasia; WT mice had an increased number of intestinal TUNEL-positive cells in comparison with Fn14 KO mice. Fn14 KO mice had a higher number of cells actively replicating their DNA in comparison with Fn14 KO mice. Fn14 KO mice had a higher number of cells actively replicating their DNA at the level of the lamina propria. In the AOM/DSS treatment Fn14 KO, but not WT mice, developed invasive CAC; 33% (Fn14 KO) vs 0% (WT), p<0.0001 (n=6/group); furthermore, there was an increased number of cells actively replicating their DNA in Fn14 KO mice compared to Fn14 KO mice treated with DSS only.

Conclusion: Our data demonstrate a critical role of Fn14 in regulating intestinal injury and suggest that colitis-associated tumorigenesis observed in Fn14 KO mice might be due to lack of apoptosis of damaged epithelial cells, free to replicate their DNA and starting colonic epithelial proliferation and tumor formation.
I am the managing editor of Pathogens and Immunity, a new medical journal at Case Western Reserve University. I recently spoke with Tracy J. Wilson-Holden about having a space at the Research ShowCASE where I can present a free-standing banner and hand out postcards. You can read more about our journal at www.paijournal.com.

Thank you,
Rob Lucas
Managing Editor
Abstract

There have been many advancements in the development of prosthetic legs that allow users to engage in athletic activities due to refinement in design and a greater variety of available materials. However, individuals who engage in non-routine athletic activities may find their prosthetic dissatisfying. In this project, we designed a prosthetic foot for a twelve-year-old girl who is an active majorette and participates in choreographed dancing and baton twirling. Our design focused on creating a prosthetic foot that could provide more spring in her step, allow her to pivot more easily, weighed less than her current foot, and could integrate into her existing device. An initial prototype was constructed using a leaf-spring design made from carbon fiber. Carbon fiber was selected as it is a strong material that is also lightweight and has some flexibility. While the prototype was able to maintain its original shape after compression testing, the amount of deformation under the applied load was deemed unacceptable. Further research revealed that the design of the foot needed to be revised such that the weight of the user would be distributed throughout the base of the foot rather than at the location of the ankle attachment. To accomplish this, an L-shape design was used with a C-shaped component located under the heel. The C-shaped component takes the place of the leaf spring and provides the ‘spring’-back necessary for athletic movement. This design, also fabricated using carbon fiber, was analyzed using Finite Element Analysis (FEA) under various loading conditions. The results confirmed that this design was more robust and better able to withstand loads associated with walking and jumping. Future work will include verification of the design output using compression testing and shear testing. Validation that our design meets the needs of the user will also be completed by manipulating the stiffness and compliance of the foot design to best match the user’s needs.
The CWRU LaunchNet helps students and alumni turn their ideas into products and services.

We wish to have table or booth presence in the context of the CWRU community researchers, scientists, innovators, and designers describing the roles, services and processes available to them from the CWRU LaunchNet.
Primary open angle glaucoma (POAG) accounts for ~75% of glaucoma in the Western world and is a phenotypically and genetically complex disease. More than a dozen genetic loci have been identified that mediate POAG. The NEIGHBORHOOD consortium has one of the largest collections worldwide of POAG cases and controls and aims to expand glaucoma genomics knowledge to better understand the disease mechanisms and genetic architecture. We approached this goal by expanding the testable area of the genome beyond previous glaucoma genome-wide association studies (GWAS) through imputation and meta-analysis, and by evaluating these results in the context of pathways. Single-variant results from the NEIGHBORHOOD were evaluated with the Pathway Analysis by Randomization Incorporating Structure program (PARIS) v2.4.0a4, a new Python implementation in the Biofilter 2.0 software suite using the Library of Knowledge Integration database, the CEU Region panel, 10,000 permutations, and the Kyoto Encyclopedia of Genes and Genomes (KEGG) pathway database. We set a significance threshold of P<0.0001; pathways attaining this threshold were interrogated further to identify significant (P<0.0001) genes. Of the 293 KEGG pathways, 33 were significant; 1882 unique genes comprised these pathways. Approximately 77% of these genes were only observed once, while 449 genes were significant in ≥1 significant pathway. Of the significant genes that appeared in significant pathways, 78% were observed once, and 42 were in ≥2 significant pathways. Over 60% of genes were individually significant in three pathways: selenocompound metabolism, phenylalanine, tyrosine, and tryptophan biosynthesis, and basal transcription factors. Identifying novel POAG pathways will help to define the underlying mechanisms of POAG by identifying proteins and molecular pathways that influence pathogenesis. This information may help identify biomarkers for early molecular diagnosis and treatment and improve prevention strategies.
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 25 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. In five years of operation, the MORE Center has amassed over 250 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

Since the advent of the microfluidics, notably, the most benefitted field from microfluidics is biological and cellular research. Traditional soft lithography and lamination based fabrication, though being the most accepted methods; they have limitations such as, inability to create complex, standalone devices. Modular fabrication approach is an added advantage to the traditional fabrication technique to overcome these limitations, but possess additional complicity of numerous assemblies. One of the biggest challenges in microfluidics is to build a single-step, stand-alone microfluidic device. Additive manufacturing holds a significant promise for the next generation microsystem fabrication such as, stand-alone microfluidic devices. Presently, building 3D printing based stand-alone microfluidic devices with fully embedded microchannels for applications in biology and medicine has the following challenges: (i) limitations in achievable design complexity, (ii) need for a wider variety of transparent materials, (iii) limited z-resolution, (iv) absence of extremely smooth surface finish, and (v) limitations in precision fabrication of hollow and void sections with extremely high surface area to volume ratio. We developed a unique hybrid manufacturing approach to fabricate stand-alone microfluidic devices with integrated manifolds and embedded microchannels. This novel technique combines 3D printing and laser micromachined lamination technique and able to provide: (i) increased design complexity in 3D, (ii) improved control over micro-flow behavior in all three directions and in multiple layers, (iii) transverse multilayer flow and precise integrated flow distribution, and (iv) enhanced transparency for high resolution imaging and analysis. In this new fabrication method, we exploit the minimized fabrication steps enabled by 3D printing, and reduced assembly complexities facilitated by laser micromachined lamination method.
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’s goal is to increase the centers’ visibility, and make their physical and intellectual resources accessible in a user-friendly way. The group aims to expand the awareness of center capabilities to both internal CWRU users, and externally, to other academic and industrial users. Our booth will consolidate information from participants in the group, including a short description of individual capabilities, links to web pages, 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.
A Study in Performance of Bayesian Modeling in Diffusion MRI

Introduction
Diffusion weighted imaging (DWI) is one of the advanced in vivo tools for providing neural fiber tractography. Because fiber track mapping requires high spatial and angular resolution at the voxel level to resolve the fine structure, various statistical models have been proposed to determine the orientation of fibers within a voxel. Since voxels having two crossing fibers commonly arises across the brain, which may cause failure of convergence in statistical estimation, it is imperative that methods more reliably estimate fiber crossing parameters under this scenario.

Method
At first, we simplify Behrens’s model to reduce model complexity, dependent upon manipulating the diffusion weighting factors in data acquisition. We then reduce down from 3D to 2D angular space before estimating the fiber orientations, by rotation techniques that rely on identification of a longitudinal axis in the 3D intensity surface. At a second stage, we apply the Markov Chain Monte Carlo method (MCMC) to estimate the remaining parameters (f1, ?1, ?2). The performances of Bayesian estimation on the unknown parameters are compared across different prior specifications.

Result
In a non-informative Bayesian prior setting, the estimation of the focal parameters (f1, ?1, ?2) performs well in most cases, under the condition that two separate fibers are separated by an angle greater than 60 degrees. When two fibers come closer, the phenomenon of label switching may arise, in that the posterior distribution of parameters would have bimodal distribution, and the pairing of f1 and ?1 gets entangled with f2 and ?2. This is caused by a lack of identifiability in the modeling under sample size limitations. However, with informative Bayesian priors, when the prior standard deviation of fiber orientation is more precise, the problem of label switching can then be resolved for much lower thresholds of angular separation.
Photodynamic Therapy (PDT) is an emerging field in the treatment for a variety of skin cancers and diseases. PDT uses photosensitizing drugs that destroy malignant cells only when they are activated by light. Previous studies have shown the efficacy of the DNA analog 4-thiothymidine (4tT) in photosensitizing rapidly-dividing malignant cells. Its phototoxic activity and low off-target effects make this thiobase a highly promising PDT candidate. However, the depth of tissues able to be treated with 4tT is limited by its absorption cutoff at ~365 nm. A thiobase photosensitizer able to absorb longer wavelengths of light is needed because longer wavelengths are able to reach more invasive skin cancers. Recently, we have found that doubling the sulfur substitution of the nucleobase increases its photoreactivity and simultaneously shifts its absorption spectrum into the near-visible region (~395 nm) where light is able to penetrate more than 100% deeper into tissues. Our initial in vitro screening with epidermoid carcinoma cells (A431) has revealed several doubly-substituted thiobase antimetabolites that are effective photosensitizers. Cell proliferation assays were used to determine the optimal thiobase doses that do not significantly impact cell survival in the absence of UVA light (360-400 nm). Up to 60% of the thiobase treated cells were killed upon exposure to UVA light, while the same dose of UVA light had no effect on untreated cells. Our novel agents are highly effective against skin cancer and have the ability to be photoactivated in deeper human tissues than the recently reported 4tT photosensitizer. This study fuels the prospect of investigating these new thiobase photosensitizers as UVA chemotherapeutic agents against skin cancer. The authors acknowledge the CAREER program of the National Science Foundation (Grant No. CHE-1255084) for financial support.
Abstract

In the United States, living will and physician-assisted suicide policies can often only be applied when an individual is given a terminal diagnosis with a prognosis of 6 months or less left to live. However, this limitation can restrict the availability of this option to individuals who have more drawn-out terminal illnesses with ambiguous timelines of disease progression. My capstone will assess the ethical dilemmas within limiting these policies only to those with clear-cut prognosis of six-months left to live (for physician-assisted suicide policies, this assessment will only apply to those states where it is currently legal). My main position is that limiting the policies to apply to only those with that specific terminal prognosis is problematic due to prognostic error with terminal illnesses and the apparent promotion of the value of the autonomy and dignity of certain individual’s more predictable diseases over those individuals with terminal illnesses with less predictable disease trajectories. The project will address the potential slippery slope associated with broadening the scope of these policies. This project will also address the problem of prognostic error that makes the requirement of a terminal prognosis even more problematic. My project will assess this topic with an interdisciplinary approach, including the application of bioethical, economic, legal, medical, and political perspectives.
**Abstract**

Computer vision-based motion measurement is potentially a cost effective way for non-contact monitoring the health conditions of civil infrastructures, especially for situations where accessibility is restricted and does not allow installation of conventional monitoring devices. Besides, an advantage of computer vision-based structural health monitoring (SHM) system, which allows for remote measurement, is to reveal global behaviors relevant to the structural performance while not introducing extra mass or disturbance to the normal service demand on the structures. Real time image analysis is the key to achieve real time computer vision based SHM system. This article describes the development of a computer vision-based real time displacement measurement system and demonstrated its performance on a large ¼ scale wood truss bridge model. Digital images were captured with an ordinary consumer grade video camera. Three common types of computer vision algorithms are compared, including the Lucas-Kanade (LK) template tracking algorithm, inverse compositional (IC) algorithm (an extension of LK algorithm), and Digital Image Correlation (DIC). Application to the model bridge subjected to loading process indicates that the IC algorithm achieves real time processing of video record to achieve real time displacement measurement. The performance in displacement from computer vision analyses matches the data collected by the conventional displacement sensors, with an average precision of within 1 mm at a distance of 5m away from the structure. The processing speed of the IC algorithm is over 300 faster than the conventional LK algorithm and around 140 times faster than Digital Image Correlation (DIC). IC algorithm achieves real time simultaneous multi-point displacement measurement with no prior installed target on the testing structure. The system performance can be significantly improved with further refinement of system hardware (such as high resolution videorecorder).

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**Title**

*Computer Vision Algorithm for Real Time Measurement of the Dynamic Displacement Field of a Large-Acale Arch-Truss Bridge*

**Key Words**

- Structural health monitoring
- Computer vision
- Lucas-Kanade algorithm
- Inverse compositional algorithm
- Digital image correlation

**Abstract**

Computer vision-based motion measurement is potentially a cost effective way for non-contact monitoring the health conditions of civil infrastructures, especially for situations where accessibility is restricted and does not allow installation of conventional monitoring devices. Besides, an advantage of computer vision-based structural health monitoring (SHM) system, which allows for remote measurement, is to reveal global behaviors relevant to the structural performance while not introducing extra mass or disturbance to the normal service demand on the structures. Real time image analysis is the key to achieve real time computer vision based SHM system. This article describes the development of a computer vision-based real time displacement measurement system and demonstrated its performance on a large ¼ scale wood truss bridge model. Digital images were captured with an ordinary consumer grade video camera. Three common types of computer vision algorithms are compared, including the Lucas-Kanade (LK) template tracking algorithm, inverse compositional (IC) algorithm (an extension of LK algorithm), and Digital Image Correlation (DIC). Application to the model bridge subjected to loading process indicates that the IC algorithm achieves real time processing of video record to achieve real time displacement measurement. The performance in displacement from computer vision analyses matches the data collected by the conventional displacement sensors, with an average precision of within 1 mm at a distance of 5m away from the structure. The processing speed of the IC algorithm is over 300 faster than the conventional LK algorithm and around 140 times faster than Digital Image Correlation (DIC). IC algorithm achieves real time simultaneous multi-point displacement measurement with no prior installed target on the testing structure. The system performance can be significantly improved with further refinement of system hardware (such as high resolution videorecorder).
Abstract

Schistosomiasis is a chronic inflammatory parasitic disease caused by multi-year infection with Schistosoma species trematodes spread in many tropical/sub-tropical regions of the world. Its control and elimination was advocated by WHO in their 2020 Roadmap on NTD (Neglected Tropical Diseases), and by the 2012 London Declaration. However, effective control of schistosomiasis remains a challenging problem for populations at risk. Schistosoma parasites have a complex life cycle, alternating between human and snail hosts. We have developed new mathematical models to study schistosomiasis transmission/control, based on a stratified worm burden approach (SWB). The model accounts for in-host biology, snail ecology and host demographics. Its parameters were calibrated using control/surveillance studies from coastal Kenya. Here we apply this model to study control/elimination of schistosomiasis by different strategies including human mass drug administration (MDA) and molluscicide. We used different combinations of MDA inputs (control group, frequency and coverage) to attain a specific goal of elimination or targeted reduction. Repeated MDA of high frequency (annual or higher), degree of participation (>70% coverage), or a broader control group (community-wide vs children) was shown to gain substantial reduction of infection. However, we also found that parasite reproduction and transmission were sufficiently robust to bring system back to pre-control level once MDA is suspended. So MDA alone is unlikely to interrupt transmission. Next we employed a model of snail population biology coupled to human SWB, to extend the scope of study to molluscicide control and to combined “MDA+snail” control. Combined strategies were shown to attain substantial improvement compared to MDA or molluscicide alone. We also conducted cost-benefit analysis of different control strategies (combined vs single MDA), to provide specific guidelines for policymaking decisions on schistosomiasis control.
ATP hydrolysis by UPF1 promotes translation termination and premature stop codons

The accurate transmission of genetic information from DNA to mRNA to protein is critical for life, however, errors in this pathway occasionally occur. This work examines the molecular mechanism of an evolutionarily conserved quality control pathway responsible maintaining the fidelity of gene expression by recognizing and removing these errors.

Abstract

Premature termination of translation arising from nonsense mutations in the protein coding region of an mRNA results in truncated polypeptides with potentially deleterious function in the cell. Nonsense-mediated mRNA decay (NMD) is a quality control pathway which exists to limit production of these aberrant protein products by recognizing the nonsense-containing mRNA and targeting it to accelerated degradation. Recognition and rapid destabilization of NMD substrates requires a conserved machinery consisting of the proteins UPF1, UPF2, and UPF3. How the relative position of the terminating ribosome is monitored by the NMD machinery and communicated to the mRNA decay machinery remains unclear. Using budding yeast as a model, we show that the ATPase activity of the RNA helicase UPF1 is required for efficient translation termination at premature stop codons, and that this functional interaction with the terminating ribosome is required for targeting the mRNA to rapid decay. Expression of ATPase-deficient UPF1 results in the accumulation of 3’ mRNA decay fragments harboring ribosomes stalled during termination. Moreover, we demonstrate that the role of UPF1 in premature translation termination requires RNA binding in cis, as well as an association with NMD co-factors UPF2 and UPF3 in a manner independent of their proposed role in activating UPF1 ATPase activity. These results establish a functional link between UPF1 and the terminating ribosome, and demonstrate that regulation of termination efficiency at nonsense codons by UPF1 is critical for recognition and destabilization of NMD substrates.
Animals as models for robot mobility and autonomy: Crawling, walking, running, climbing and flying

We incorporate neuromechanical principles of locomotion and autonomy into robot designs. The goals are to develop useful mobile robots and to use robot models to help us better understand animal neurobiology and mechanics. A robot that captures the leg designs important for animal locomotion will be extremely agile and suitable for many missions. However, before a robot with the intricate leg designs and energy efficiency of an animal can be deployed some technical issues must be solved. Therefore, we are using two complementary approaches to develop mobile robots. Using the direct approach we have developed a number of robots with multi-segmented legs designs of animals. For these robots, we are developing biologically-realistic neural control networks based upon animal neurobiology. In the second approach the fundamental principles of 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 in the near term such as amphibious operations and search and rescue. This abstracted approach has also been used to develop a small vehicle called MALV (micro air and land vehicle) that flies, lands and crawls. MALV’s compliant running gear permits it to crawl away from hard landings and its compliant wings help to stabilize it in flight. We are also developing structurally soft robots such as Softworm, which crawls via continuous waves, for pipe inspection. 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. Robot 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.
Cytokines play an important role in creating an inflammatory microenvironment, which is now considered a hallmark of cancer. Although tumor cells can exploit cytokine signaling to promote growth, invasion, and metastasis, the response of normal and premalignant epithelial cells to cytokines present in a developing tumor microenvironment remains unclear. Oncostatin M (OSM), an IL-6 cytokine family member responsible for Signal Transducer and Activator of Transcription 3 (STAT3) activation, has been implicated in cancer development, progression, invasion, and metastasis. Paradoxically, OSM can also suppress the growth of normal cells and certain tumor-derived cell lines. Using normal human mammary epithelial cells (HMEC), we found that OSM signaling engaged a p16- and p53-independent, growth-inhibiting senescence response that required STAT3 activity. Moreover, we identified a novel link between OSM-activated STAT3 and Transforming Growth Factor-beta (TGF-beta) signaling pathway. Inhibition of functional TGF-beta/SMAD signaling by expressing a dominant-negative TGF-beta receptor, treating with a TGF-beta receptor inhibitor, or suppressing downstream SMAD3 expression using a SMAD3-shRNA prevented OSM-induced senescence. OSM promoted a protein complex involving activated-STAT3 and SMAD3, and induced the nuclear localization of SMAD3 as well as SMAD3-mediated transcription. Our findings suggest that a novel STAT3/SMAD3-signaling axis is required for OSM-induced senescence. Our current studies are defining how this key tumor-suppressive mechanism is dismantled during tumorigenesis. Understanding how developing cancer cells bypass OSM/STAT3/SMAD3-induced senescence may help identify novel targets for future "pro-senescence" therapies aiming to reengage this hidden tumor-suppressive response.
Previous work from our laboratory, using an intratracheal bleomycin (BMi) based model of acute lung injury has shown that BMi rats displayed elevated brainstem inflammation and blunted synaptic transmission in the nTS (nTS), brainstem nuclei crucial for generating and processing autonomic reflexes. We hypothesized: 1) BMi lung injury promotes synaptic depression through changes in post-synaptic glutamate receptor (GluR) expression, and 2) that synaptic depression can be ameliorated by minocycline, a microglial inhibitor, injected daily intraperitoneally (ip) following BMi.

In BMi rats (n=9) compared to intratracheal saline (Si) ‘control’ rats (n=8), the nTS had greater immunoreactivity for the GluR2 subunit of the ?-amino-3-hydroxy-5-methyl-4-isoxazolepropionic acid (AMPA) receptor, but no significant changes to GluR1 and GluR4 subunits. Furthermore, minocycline ip treatment during the course of lung injury reduced the augmented GluR2 immunoreactivity in the nTS of BMi rats.

The GluR2 subunit is strongly associated with reduced spontaneous excitatory postsynaptic (sEPSC) current amplitude because it lowers calcium conductance. Therefore, using whole-cell patch clamp, I recorded nTS neurons that received direct input from primary sensory fibers associated with cardiorespiratory and chemosensory reflexes. Neurons from BMi rats had reduced amplitude and prolonged rise time of sEPSCs compared to Si rats that were significantly augmented in minocycline treated BMi rats but not significantly different from Si controls.

In summary, BMi lung-injury results in post-synaptic depression of sEPSCs in neurons of the nTS, which also has increased GluR2 expression. These processes are reversed by minocycline treatment. Thus we conclude that microglia regulate this process and that neuroinflammation may contribute to dampened autonomic function in the setting of acute lung injury.
Evidence of disturbances in cardio-respiratory control, brainstem serotonin (5-HT) signaling, and vulnerability to infection during a critical period of development have been implicated in Sudden Infant Death Syndrome (SIDS). We showed that the second postnatal week of life in the rat is a unique period of development during which the neonate exhibits a heightened vulnerability to pro-inflammatory challenges. Ten day old rats injected with the bacterial endotoxin, lipopolysaccharide (LPS), showed disturbances in breathing; this was associated with an unexpected degree of mortality that occurred several hours after LPS treatment. These profound effects of LPS were unique to this age group as younger (5 day old) and older (20 day old) rats appeared relatively resistant to LPS. Since the brainstem is an important region for cardio-respiratory control, we then investigated whether there were changes in cytokine mRNA expression in 10-day old rats 2 hours following LPS. LPS increased IL-1?, iNOS, IL-6, and TNF? mRNA expression compared to untreated control rats. To our surprise, LPS also disturbed mRNA expression of brainstem SERT (a 5-HT re-uptake transporter) and the 5-HT type 1A (5-HT1A) receptor expression in 10-day old rats. These data hint at a previously unrecognized role for cytokines in mediating the disturbances in brainstem 5-HT signaling, respiratory dysfunction, and vulnerability of SIDS victims during a critical period of development.
Controlling subpopulations of unmyelinated axons within peripheral nerves make it possible to treat a very wide variety of clinical syndromes. Within the last few years, implanted neural devices have been developed to control peripheral nerve activity. Infrared (IR) light has recently been described as a promising modality for control of neural. Previous studies have shown that brief pulses of IR can induce excitation of neurons. Recent studies have shown that IR can inhibit neurons with high spatial specificity. We found that smaller diameter axons with slower conduction velocities have lower thresholds for infrared block than larger diameter axons with faster conduction velocities.

To evaluate infrared settings that can effectively block compound action potentials in an unmyelinated nerve, we used Aplysia pleural-abdominal connectives to establish reliability and repeatability of block. We hypothesized that the block will progress through the following events: selective block of smaller diameter axons, complete block of both small and large diameter axons with immediate reversibility, complete block with delayed reversibility, complete block with partial reversibility and irreversible complete block.

We found that we could rapidly, repeatedly and reversibly inhibit action potential propagation in the slower conducting smaller axon before inhibiting the faster conducting larger axon. The shortest delay between the onset of infrared and the partial block of the smaller axons was about 2 sec. This delay became longer as we decreased the radiant exposure. We also found that we could consistently block those axons for a long period of time (e.g., 2 hours) with either immediate or delayed reversibility.

These results suggest that it may be possible to use IR light as a selective blocker of unmyelinated C fibers. In future studies, it may be possible to establish whether this could serve as a novel treatment for significant clinical challenges such as chronic pain.
Abstract

Biomechanics, which is the study of how the mechanics of the body affect both its abilities and its limitations, is the complementary partner to neural control in understanding how behaviors are created. Characterizing the biomechanics of soft bodied organisms, such as worms, slugs and squid, are especially challenging and has clinical implication for understanding structures such as tongues and the digestive system. These creatures can also serve as the inspiration for soft bodied robots, which can grasp and move through environments unsuitable for rigid systems. The feeding grasper of Aplysia californica, a soft bodied structure, has a long history as a model of neural control. Its surface undergoes conformational changes as it opens and closes, allowing it to grasp food of complex and differing shapes. The opening of the grasper had been attributed to the action of the I7 muscles, but experiments in our lab have shown that removing these muscles has no effect on opening. We have, however, discovered fine muscular fibers underlying the tissues that produce openings in reduced preparations. Lesions of these tissues in intact animals greatly impair openings. A 3D model based on high resolution MRI data validates the role of these sub-radular fibers in radular opening. Understanding the details of the motor control of the grasper in Aplysia is likely to be of use for understanding the motor control of soft muscular structures in general.
Title: Handheld Mirror during Children’s Dental Treatment: a Pilot Study

Abstract

Objectives: To investigate the impact of the handheld mirror on children’s behavior during dental treatments.

Methods: 14 children (the mean (SD) of age was 7.75 (2.88) years old, age range was 4-13 year old, 7 were boys) who visited a pediatric dentistry clinic for restorations participated in this study. Their parent/guardian completed dental anxiety/fear questionnaires (the Parental version of the Dental Subscale of the Children’s Fear Survey Schedule (CFSS-DS)) and the children answered a 5 option (very unhappy to very happy) Likert scale about their feeling before treatment. After being randomly assigned to continue with or without a handheld mirror, children received restorative treatments. Their behavior was assessed by their pediatric dentists using Frankl Behavioral Rating Scale for cooperative behavior. At the end of the treatment, the children who used the handheld mirror were asked whether they want to use it again in the next visit (scale was “Not at all”, “Little”, “Yes or no”, “Yes”, and “Definitely yes”).

Results: There was no significant difference in the comparison of characteristics, age, gender, CFSS-DS, or child’s feeling before treatment between children with and without access to a mirror, 100% of children who used the mirror wanted to use it again at future appointments.

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<td>0%</td>
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<td>Without mirror</td>
<td>0%</td>
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Chi-square test did not show significant difference for cooperative behavior (Chi-square=1.700, df=2, p=0.427), however, 100% of children who used the handheld mirror stated that they want to use it in next visit (“Yes”: 1, “Definitely yes”: 6).

Conclusion: The handheld mirror might help children to receive dental treatment.
As a sponsor, we are requesting booth space near CWRU's Clinical and Translational Science Collaborative.
Big data offers opportunities in modern research. Statistics is in the central stage of big data and data science. The mission of the Center for SR2c is to pursue sound and reproducible research, develop innovative data analytics, and support statistical study design, analysis and interpretation of data, without borders. The SR2c is open to all schools and scientists, medicine or non-medicine, in and outside CWRU, who seek practical statistical and data analytics support, collaboration, innovation, research and opportunities. We provide state-of-the-art statistical research and interdisciplinary collaboration opportunities. At our booth, we will showcase our mission, expertise, research and collaboration examples, including those for complex and big data, via videos, movies and demos, and respond to questions. **Freebies in this 2016 showcase will include FREE on-site statistical consulting**. Come to visit us and better yet bring your statistically challenging questions and problems, or simply come to talk or see what our new statistical software packages can do.

**Elevator Speech**

Statistics is the science of data. Sound statistics plays a critical part in modern research, practice and policymaking, especially in BIG DATA research. SR2c pursues state-of-the-art statistical research and interdisciplinary collaboration. SR2c will showcase its expertise, product, research and collaboration examples, and provide free statistical consulting at Showcase.
**Title:** A Role for Interferon Beta (IFN?) in Suppressing Breast Cancer Tumor Recurrence

**Abstract**

Tumor recurrence is a major therapeutic obstacle that prevents successful elimination of breast cancer. Cytokines within breast tumor stroma influence tumor recurrence following chemotherapy by altering the balance between cancer stem cells (CSC) and non-CSC. Oncostatin M (OSM) a cytokine aberrantly elevated in breast cancer stroma generates CSC and correlates with breast cancer recurrence. In contrast, elevated IFN? in breast cancer stroma correlates with improved survival. We hypothesized that IFN? improves survival by inhibiting CSC generation to suppress breast cancer recurrence. We examined the ability of IFN? to oppose OSM-induced CSC. We assessed activation of the major IFN? induced transcription factor, Interferon stimulated Gene Factor 3 (ISGF3: STAT1, STAT2, IRF9) and determined this complex is necessary for inhibiting OSM-induced CSC. A genetically-defined human mammary epithelial cell (HMEC) transformation model was used to test impact of exogenous cytokines on CSC generation. Transformed HMEC were chronically exposed to OSM alone, IFN? alone or OSM and IFN? together. Flow cytometry and anchorage independent growth (AIG) were used to gauge CSC generation. Western analysis was used to determine activation of the IFN?-mediated ISGF3 complex. Chronic exposure to OSM alone generated CSC populations within transformed HMEC. Combined exposure with IFN? suppressed OSM-induced generation of CSC and AIG while activating the ISGF3 complex. Likewise, inhibition of STAT1 by shRNA resulted in enhanced OSM-induced CSC generation. Our results suggest IFN? may be useful in suppressing breast cancer recurrence and patient mortality by specifically inhibiting CSC generation. We show that IFN? successfully inhibits OSM-induced CSC and AIG in a STAT1 dependent manner. Our work demonstrates utility of a HMEC transformation model to study how cytokines, OSM and IFN?, regulate CSC populations. Future studies will analyze the other ISGF3 components in IFN? inhibition of CSC.
Abstract

Alternative splicing (AS) plays a key role in increasing protein diversity and modulating gene expression levels in different stages of development. Though the testis transcriptome is characterized to have complex alternative splicing patterns, the regulation and functions of AS in spermatogenesis remains poorly understood. We previously demonstrated that the RNA-binding protein, Ptbp2, is essential for spermatogenesis, however the molecular basis for this phenotype was not fully explored. Here, we performed deep RNA-sequencing on whole testis from wild type and cKO mice to elucidate the function of Ptbp2. Our data suggests that Ptbp2 is an imperative AS regulator in spermatogenic cells, controlling a functionally-related network of genes involved in germ cell adhesion and membrane protein trafficking. In parallel, we interrogated the AS patterns of spermatogenesis and identified distinct AS programs in each developmental stage, as well as a role for Ptbp2 in stage-specific AS regulation. Together, these results demonstrate new insights into the importance of AS in mammalian germ cell development and describe a central role for Ptbp2 in its regulation.
OBJECTIVE: To determine the association between delay in seeking TB treatment and geographic distance measured by network travel time (in minutes) and Euclidean distance (in kilometers) and to identify other risk factors from selected covariates and how they modify the core association between delay and distance.

METHODS: This was part of a longitudinal cohort Tuberculosis (TB) study called the Kawempe Community Health Study based in Kampala, Uganda conducted April 1, 2002 to December 31, 2006. The dependent variable was delay measured as the number of days from the start of cough symptom. Main independent variables were network travel time (in minutes) and Euclidean Distance (in kilometers). Distance calculations were made between patient homes to TB clinic. The covariates were organized and presented according to the Andersen Utilization Model.

ANALYSIS: Bivariate analyses using Chi-square, student-t and Wilcoxon’s test were performed and significant variables (p<0.2) included in the multivariable model. A series of probit regression models were fit to examine the association between delay, geographic distance and covariates.

RESULTS: A total of 325 patients were included in the analysis. There was a predicted probability of delay of 0.73 (95% CI: 0.51 -0.89) associated with the median travel time of 46.7 minutes in a multivariable model. Euclidean distance was not significantly associated with delay: 0.43 (95% CI: 0.31-0.56). Education and hemoptysis were protective against delay.

DISCUSSION: Including network travel time with other risk factors may be important in identifying populations especially vulnerable to delay.
The effectiveness of a robotic snowplow depends on the area covered by its plow and the path it takes. Therefore, it is important to define a continuous path that will correctly move snow instead of just using a few discrete waypoints or defining an area that needs to be cleared. However, defining a continuous path is more complex than having a list of waypoints or defining the boundaries of a rectangle.

Here we present a hybrid solution that uses a parameter-driven, force-based set of differential equations to build a continuous path between an arbitrary number of high level waypoints that contain position, orientation and velocity information. This allows the full path to be generated and verified before the robot moves, and a new path to be created to adapt to new obstacles that were not visible to the robot during the initial planning phase. A basic proportional curve following algorithm is used to make the robot drive along the designated path.

The path generation and following algorithms are tested in simulation and on a mobile robot. Testing of the hardware platform was done in both a clean test field and a competition snowfield. A range of parameters were used, and the advantages of different parameters are discussed.
Introduction
Priapism has been defined as prolonged erection without sexual stimulation for a period of more than 4 hours. Amongst the few reported cases of priapism induced by anticonvulsant medications, phenytoin, pregabalin and valproate have been implicated but only one case report exists for priapism associated with carbamazepine. We present a case report of a patient who presented with priapism after carbamazepine usage.

Method: Case Report
A 44 year old male nursing home resident with a past medical history of intellectual disability, cerebral palsy and seizures on carbamazepine presented with priapism, requiring an emergent urological intervention and evacuation of corpus cavernosum. He was taking 300 mg of carbamazepine in the morning and 200 mg in the afternoon. He was on other medications but none of them were known to cause priapism. All other probable causes for priapism; such as trauma, malignancy, metabolic disorders, alcohol were ruled out. Carbamazepine was discontinued and switched to Levetiracetam and patient did not have any other episodes of priapism.

Discussion
Ischemic priapism is found to occur as a failure of the detumescence mechanism, from either an excessive release of neurotransmitters or a blockage at the level of draining venules or prolonged relaxation of the intracavernous smooth muscles. Carbamazepine which is commonly used as an antiepileptic, is also indicated in managing trigeminal neuralgia and manic or mixed episodes of bipolar disorder. It primarily functions by prolonging the inactivation of sodium channels, but has also been found to increase extracellular serotonin levels and increase dopaminergic transmission, inhibit glutamate release and decrease cyclic AMP level. An array of adverse effects has been reported with carbamazepine including dry mouth, constipation, dizziness, headache, hematological toxicity and hypersensitivity reactions. FDA however does not enlist prolonged erections as a side effect of carbamazepine.

Conclusion
We are presenting a case report on medication induced priapism (prolonged erection without sexual stimulation) following the use of carbamazepine which is an antiepileptic drug. Anticonvulsant induced priapism is a rare occurrence and more research is required for a better understanding of the mechanism as well as frequency of occurrence.
Since perovskite solar cells were discovered as a viable active material for next-generation photovoltaic devices, their instability in humid environments has been a constant challenge. Therefore, understanding the exact degradation mechanism is a crucial need before being able to improve the stability and durability of these exceptional materials. In this work we demonstrate that the CH3NH3PbI3 perovskite will eventually degrade irreversibly at high humidity through a slow leaching and vaporization process of CH3NH2. Deuterium oxide (D2O) was used as humidity source instead of water molecules (H2O) for better tracking of moisture diffusing into the perovskite after sample fabrication. The degradation process of CH3NH3PbI3 perovskite sample was examined directly by using a time-of-flight secondary ion mass spectrometry (ToF-SIMS) with a pulsed Bi32+ primary ion as analyzer source and a high-energy Ar2500+ gas cluster ion beam (GCIB) for layer-by-layer in situ sputtering. 3D images were reconstructed from the slice-and-view images to study the distribution of the D2O moisture penetration in the specimen. It is observed that the initial attack occurs via proton exchange on the organic molecule. The intermediate products of this degradation reaction are also analyzed. The products of this reaction are CH3NH2D, CH3NHD2 and CH3ND3. This humidity-induced degradation-vaporization process leads to drastic changes in morphology, crystallography and performance of perovskites.
**Title**

Clinical-Community Partnership to Promote Fruit & Vegetable Consumption among Food Insecure Patients with Hypertension in Safety Net Clinics

**Abstract**

Background: Although prior studies linking patients with farmers' markets (FM) have shown improvements in consumption of fruits and vegetables (FV) in select populations, less is known regarding successful implementation strategies for program delivery within safety net clinics.

Objectives

• Leverage hypertension visits, using produce prescriptions, to encourage patient behavior change and linkage to community resources for FV.
• Evaluate intervention effectiveness on utilization of FM and change in fruit and vegetable consumption over 2-3 months.

Intervention: Health Improvement Partnership – Cuyahoga worked with 3 clinics to implement and evaluate PRxHTN, which involves blood pressure measurement, nutrition counseling, and four $10 vouchers to purchase produce at FM at each of three monthly provider visits. Clinics received assistance to integrate PRxHTN within existing healthcare-system. Patient participation was tracked using unique de-identification numbers noted in the electronic health record system (EHR), on surveys, and FM produce prescriptions/vouchers. FV screener was conducted at baseline and 3-months post.

Summary of 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 improve FV consumption among food insecure adult patients with hypertension.
Case Study SuperCoach Program- The Impossible Patient

By Kathryn Connors

Background: AmeriCorps Members are trained in motivational interviewing (MI); an evidence based counseling style that has demonstrated efficacy for facilitating positive health behavior change. Coaches work with patients to help them lose weight, quit smoking, increase physical activity, and better manage their health conditions.

Objective: To explore processes used to work with an uncooperative patient to improve medication adherence. This abstract will exemplify the potential effects of counseling patients through MI to reach common ground with patients.

Method: MI encourages an individual to go from a place of ambivalence to a place of change. This case documents that process.

Case Study: A patient with limited English proficiency was refusing medications needed to treat a blood clot. When I walked in, I discovered that the reason why she was screaming was because she was hard of hearing. From my training in MI, I knew that building trust was important. I took a piece of paper and wrote to her that I was a health coach and that I helped people with whatever they wanted to work on. She grabbed my hand and rested her head on my shoulder. Our trust was growing. I explained that I can help her make some health goals. She decided to take her medicine and cooperate with the care team. I believe she complied with her medical advice because she was able to comply with herself, to accept herself and not deny herself her own autonomy; the essence of MI.

Conclusion: Clinicians may not be prepared to communicate effectively and engage patients. AmeriCorps Service Members trained in MI can be an important link to improve patient care.
Akt/protein kinase B and transcription factor NF-κB are important signaling molecules and key survival factors involved in the control of cell proliferation, apoptosis and oncogenesis. Akt and NF-κB are components of separate signaling pathways and regulate downstream signaling by controlling multiple target genes. Previous studies from our laboratory have shown constitutive NF-κB/p65 activation and aberrant activation of PI3K-Akt pathway in human prostate adenocarcinoma, which progressively increases with increasing tumor grade. The expression of these molecules during cancer progression has been validated in an autochthonous mouse model of prostate cancer, TRAMP. Several inhibitors of both the pathways have been tested in clinical trials with limited success. This study provides a background to test our hypothesis that a combination of Akt and NF-κB inhibitors might be more efficacious than the use of single agent. For these studies we utilized two human prostate cancer cell lines viz. androgen-responsive LNCaP cells, (possessing increased Akt activity due to mutation in PTEN gene) and androgen-refractory PC-3 cells with constitutive activation of Akt and NF-κB. Treatment of both cell lines individually with inhibitor VIII (0.075-1.8µM) and parthenolide (0.32-60µM) for 24-72 hrs exhibit a suppressive effect in cell growth assays. A combination of inhibitor VIII and parthenolide in 1:5, 1:10 and 1:20 molar ratio (0.5µM+5.0µM); (0.5µM+10.0µM); (1.0µM+5.0µM); and (1.0µM+10.0µM); where the highest dose at 1:10 ratio showed maximum efficacy in cell growth inhibition in both cell lines. Furthermore, a combination treatment with inhibitor VIII and parthenolide led to a decrease in p65/RelA and Ser536-p65/RelA expression in both cell lines, compared to individual treatments. The reduced expression of NF-κB and its phosphorylation in combination treatment of inhibitors supports our hypothesis that combined treatment is more efficacious than the use of a single inhibitor.
**Abstract**

Strabismus is a disorder in which both eyes do not line up in the same direction, and are consequentially incapable of focusing on the same object at the same time.\(^1\) The condition is more commonly known as "crossed eyes." For this device, a prototype has been developed that measures strabismus without using the traditional prism method. This device uses Infrared LED lights, a camera, and a software algorithm to measure the angle of deviation in their eyes. This design is an innovative iteration in the development of this Strabismus measurement device.
The focus of this capstone is on mobile payments for five developing countries. Kenya's M-PESA system of mobile payments, supported by Vodafone, is known as one the most successful, if not the most successful, system of mobile payments in the world. This purpose of this capstone is to gain insight on why Kenya is so successful in establishing a system of mobile payments relative to some of their peer countries. The nations that I compare to Kenya are Bangladesh, Cambodia, Cameroon, Côte d’Ivoire (Ivory Coast), and Tanzania.

The peer countries were carefully selected using two main criteria: 2015 GDP per capita data via the CIA World Factbook and the Human Development Index Score (HDI). In order to qualify as a peer country, they had to fall within a range of thirty spots of Kenya in HDI and within a thousand dollars in GDP per capita. Kenya is ranked 145th in HDI and had a GDP per capita of 3,300 in 2015; therefore, a country can only be designated as a peer if their HDI rank is between 115 and 175 along with a GDP per capita between 3,000-4,000.

The variables I use to analyze the success of mobile payments of the countries are:
- Consumer understanding and willingness to use mobile payments within the respective country.
- Environmental, demographic, and technological factors within a country.
- Effectiveness of formal financial services domestically.
- Partnerships among banks, mobile network agents and the government.
- Legal and regulatory structure of each country.
The Leonard Gelfand STEM Center leverages the resources of Case Western Reserve University to engage preK-12 students in activities that introduce them to scientific practices and concepts and inspire a lasting interest in science and engineering.

Vision

The Leonard Gelfand STEM Center at Case Western Reserve University will change students’ lives in northeast Ohio and beyond by preparing them to succeed in STEM-based careers, enabling them to make informed contributions to public discussions of important scientific issues, and fostering lifelong learning in science and engineering.
The purpose of this study is to explore the effects of two dimensions of music—synchrony and vocals—on ergometer (indoor rowing) performance. In addition, participants’ relative attention styles—associative or dissociative—were determined to see its effect on performance and music preference. Participants were drawn from experienced collegiate rowers at Case Western Reserve University. Each participant rowed 1000 meters under five different conditions: synchronous/vocal, synchronous/instrumental, asynchronous/vocal, asynchronous/instrumental and control using a counterbalanced design. Total time, stroke ratings, perceived exertion, and music preference were recorded for each condition. Preliminary results indicate that the presence of any music improves ergometer performance. The effects of vocals seem to be varied based on participant's attention style. Preliminary results also indicate music asynchrony seems to create more variance in stroke rating, but does not necessarily correlate with overall time. In addition, every athlete preferred having music to not having any, with a slight preference for vocal tracks over instrumental.
Abstract

The 15-5 PH fully martensitic stainless steel alloy is nitrided at low temperatures. Nitrogen concentration at the surface of the alloy reaches to 15 at.%, which is hundred thousand times higher than the equilibrium concentration at room temperature. Shear-like reverse transformation of martensite to austenite has been observed within 15 µm of the surface. The newly transformed austenite is formed in 40 nm thick, 500 nm long plates, which are formed martensitically. Chemical analyses of the matrix and the newly formed austenite reveal no difference in chemical composition of the two adjacent phases. The very high concentration of nitrogen, as a strong austenite stabilizer provides the driving force for this uncommon phase transformation at low temperature.
Cystic fibrosis is an autosomal recessive disease that affects 70,000 individuals worldwide. This disease stems from various mutations in the CFTR gene (cystic fibrosis conductance regulator), which helps regulate the CFTR chloride channel. With mutations, chloride channels do not function properly, leading to problems in the epithelial lining of cells in the lungs and intestines with a build-up of mucus. In this project, I used various cell culture models to quantify and analyze targeted metabolomics.

Cystic fibrosis affects various parts of the mammalian system and on a molecular level, affects several metabolic processes, including glycolysis and the citric acid cycle. Using targeted metabolomics coupled with stable isotopes ([U-13C] glucose), my project compares the metabolic signatures of cells with and without functioning CFTR gene (cystic fibrosis conductance regulator) to quantify the effects of cystic fibrosis on these processes using various cell culture models. Samples will be extracted and run through GCMS to identify and quantify levels of metabolites. Quantities will then be compared to determine whether there is a significant difference in levels of compounds. Isotopic labeling will help to “trace” the metabolic pathways and detect any differences in metabolic flux.
This overview highlights some of the key aspects regarding materials qualification needs across the AM spectrum. AM technology has experienced considerable publicity and growth in the past few years with many successful insertions for non-mission-critical applications. However, to meet the full potential that AM has to offer, especially for flight-critical components (e.g., rotating parts, fracture-critical parts, etc.), qualification and certification efforts are necessary. While development of qualification standards will address some of these needs, this overview outlines some of the other key areas that will need to be considered in the qualification path, including various process-, microstructure-, and fracture-modeling activities in addition to integrating these with lifing activities targeting specific components. Ongoing work in the Advanced Manufacturing and Mechanical Reliability Center (AMMRC) at CWRU is focusing on fracture and fatigue testing to rapidly assess critical mechanical properties of some titanium alloys before and after post processing, in addition to conducting nondestructive testing/evaluation using µCT at GE. Process mapping studies are being conducted while large area microstructure characterization and informatics (EBSD and BSE) analyzes are being conducted to enable future integration of these efforts via an ICME approach to AM. Possible future pathways for materials qualification are provided.

Enabling metal additive manufacturing/3D printing for mission/flight critical applications need extensive qualification and certification process. Through multi-scale and faceted approach, this work will provide/introduce an infrastructure to speed up qualification process.
Expansion of the genetic alphabet has long been a high priority in the field of synthetic biology. Such an achievement could enable synthesizing unnatural amino acids and proteins, as well as enhance the capabilities of site-specific labeling. In 2014, in vivo replication of an expanded genetic alphabet was reported for the first time when E.coli incorporated and replicated successfully the unnatural base pair dNaM-d5SICS. The question arises as to whether these unnatural bases are as stable to solar radiation as the natural nucleobases. Using steady-state and time-resolved spectroscopic techniques, we investigated the photophysical properties of dNaM and d5SICS in phosphate buffer and acetonitrile solution. Our results demonstrate that dNaM and d5SICS populate long-lived, reactive triplet states in ~30% and near unity yield, respectively, upon UVA excitation. Furthermore, d5SICS is able to generate singlet oxygen with a 42% yield upon 355 nm excitation. The implications of these results in the potential phototoxicity of the unnatural bases to DNA will be discussed.
Background: Cystic fibrosis is a genetic disease caused by mutations in the gene CFTR. Maintenance of a normal body mass index is a clinical goal for people with cystic fibrosis because it is associated with better pulmonary function. Despite raised recommended caloric intake, the median BMI for patients borders the recommended level and obesity is rare. Animal models of cystic fibrosis also display a lean body type. Low body mass index is typically attributed to lung disease and nutrient malabsorption. However, lean body type is present despite lack of lung disease and nutrient malabsorption in the mouse model. We postulate that CFTR could have a direct role in adipose (fat) tissue.

Hypothesis: If the morphological differences observed in fat tissue of cystic fibrosis mice are Cftr-dependent, then they will be more apparent in fat depots that express more Cftr. Therefore, we characterized fat tissue morphology in two fat depots: epididymal (highest Cftr expression) and interscapular (lowest Cftr expression).

Results: In a mouse model of cystic fibrosis, adipocyte (fat cell) size is reduced in epididymal fat tissue, but is increased in interscapular adipose tissue. Smaller cell size in epididymal fat may be indicative of remodeling of adipose tissue toward a beige-cell phenotype in response to chronic signaling for lipolysis through the ?3-adrenergic receptor. Alternatively, smaller cell size could be caused by adipocyte immaturity. These possibilities are currently being studied.
Haltere influence on gaze control in tethered Drosophila flight

Ilakkiya Thanigaivelan, Department of Biology; Shwetha Mureli, Department of Biology, Dr. Jessica Fox, Department of Biology

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. Previous studies have shown that halteres are not strictly necessary for visually-guided wing steering responses in fruit flies, but their influence on wing-steering behavior can change depending on visual context. In this study, we asked whether the halteres might influence head movements in the same way they influence wing steering. We examined the head movement behavior of intact fruit flies and flies with complete haltere ablations. Each group of flies flew on a rigid tether in multiple 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. When the flies were stimulated with visual motion, we found that haltere ablation decreased head movement responses to wide-field motion, but not to moving figures. In closed loop, fast head movements (saccades) occurred more frequently during periods in which the fly was fixating a figure in the frontal field, but did not occur more frequently during wide-field fixation. Our results suggest a complex role for the haltere in gaze control that is modulated by visual context. Although the wing-steering and head movement behaviors are different in the visual contexts tested here, the influence of the haltere appears to be similar for both.

Project Mentor: Dr. Jessica Fox, Department of Biology
The true cost of homelessness is likely incalculable; however, the societal financial cost has been studied and is routinely quoted as being $40,000 per homeless person annually. This cost includes items such as emergency room visits, shelters, court costs, jail time, etc. Depending on the geographic location, these costs have been estimated to be as high as $150,000.

Society has a common perception that homeless people are sociopaths, addicted men, living under bridges who are not willing to work. This research team acknowledges that within the homeless population, there are members of the community that fit that common stereotype, but on the other hand, we have also found a portion of the population that can be described as high potential homeless. Given the high multi-level cost of homelessness, a team of concerned community members in Northeast Ohio joined together to implement a new model to deal with homelessness that is building a path for high potential homeless women and men, living in homeless shelters, to enable them to go from being homeless to being social entrepreneurs. What follows are the early results of a longitudinal ethnographic study that looks effects of the implementation of this new model by the 501c3 nonprofit organization, Better Future Facilitators (BFF). Using a capacity building learning program and a micro-lending model, BFF provides their business owner candidates the opportunity to build and own small, for-profit social enterprises (B-Corporations). This programmatic activity has generated the current research questions: How does behavioral change occur with homeless women & men that are presented a potentially life changing opportunity? How does having hope of a better future, affect recovering addicts ability to stay “clean”? The research data that will be presented here will be preliminary and we are seeking feedback on the research related activities.
Service robots are quickly leaving the realm of science fiction and entering the world of reality. From vacuum cleaners and lawn mowers to large scale farm equipment, repetitive, and often times dangerous, tasks, are becoming more and more the responsibility of intelligent machines. And in many of these cases, a large part of their responsibility depends on the answer to a deceptively simple question: “Where am I?”

Here we present an autonomous snowplow that attempts to answer that question by intelligently combining information from several low cost, multi-modal sensors. Wheel encoders and an inertial measurement unit provide highly accurate information about the robot's relative motion, which is necessary for delicate maneuvering around obstacles. However, these sensors are subject to drift and quickly diverge from any estimate of absolute location. Wheel encoders, especially, are also sensitive to wheel slip, which is a common occurrence on snow and ice. In contrast, ultra-wideband beacons provide an external reference to localize the robot in a global frame. Individual measurements from the beacons are noisier than the other sensors. However, this error stays constant over time helping to reduce the long term effects of drift.

A final estimate of the robot's location, and the answer to our question, comes by way of an extended Kalman filter. This algorithm combines all of the incoming sensory information with a kinematic model of the robot's motion, and weights each input based on the noise model attributed to that input. And, this filtered result proves to be better than the sum of its parts.
Modern wind turbines fall into two basic categories: (1) the collinear machines, which usually include a horizontal shaft and a conventional 3-blade rotor, and (2) the orthogonal machines, which typically have a vertical shaft and a Darrieus/Savonius/H type rotor.

The main advantage of orthogonal wind turbines over the collinear ones is that the former ones need a much simpler and cheaper structure and work better under turbulent wind conditions. In addition, the orthogonal configuration allows the machine to deal with any wind speed direction, or even with multiple and simultaneous wind flows, and without the need of any yaw control system.

This project designs, develops and tests experimentally a new orthogonal wind turbine concept. It combines a Troposkien Darrieus-type rotor with an additional H-type rotor with different configurations. The hybrid lab-scale prototypes are experimentally tested in the fully instrumented wind tunnel at the CWRU Control and Energy Systems Center. The analysis of the results shows guidelines to improve the power efficiency and reduce the mechanical fatigue of the orthogonal machines.
Abstract

Regulating pesticides in residential surface soil, air, drinking water, and food is a worldwide problem since pesticide exposure can significantly impact human health. Most regulatory jurisdictions regulate individual pesticide exposures independently, although the total pesticide exposure risk depends on the cumulative exposure from soil, water, air, and food. Even for a single source such as soil, jurisdiction pesticide guidance values may vary by five, six, and even seven orders of magnitude. The highest of these values are almost certainly too high to protect human health, especially for children, and the exposures are increase even further by food, air, and other exposures. In the work presented here the most commonly regulated pesticides for each exposure pathway are analyzed. For the most important pesticides, the exposure contributions from different exposure pathways has been quantified by using risk models to convert guidance values into daily maximum implied dose limits. For many nations the sum of the daily maximum implied dose limit from each exposure may be compared. Based on this approach a ranking system has been developed to quantify how conservative a country’s pesticide exposure standards are for each exposure pathway, and for a person’s total pesticide exposure. Hopefully, these results will help regulatory jurisdictions around the world rationalize their guidance values to a set of values that are sufficiently protective of human health.
**Title**: Temperature Dependent Thermal Conductivity of Single Crystalline CH3NH3PbX3 (X = I, Br, Cl)

**Elevator Speech**: Perovskite-based solar cells have recently drawn much attention due to high efficiencies. Analyzing thermal properties of this material is important both because thermal properties are critical for solar cell device design as well as because thermal properties can elucidate its unique energy transport behaviors.

**Abstract**: Organo-lead halide perovskite (CH3NH3PbX3; X = I, Br, Cl) represents an important class of materials for energy conversion. The iodide in particular has been used to prepare highly cost effective solar cells with a photovoltaic efficiency in excess of 20%. Thermal properties of this material are relevant both from an engineering standpoint – thermal management/heat dissipation are critical aspects of solar cell design – as well as for studying the physics of energy transport in this material, especially considering the unusual hybrid organic-inorganic unit cell. Building on our previous work, in which thermal conductivity of compressed polycrystalline pellets of perovskite showed a measurable contribution to phonon scattering from the rotation of the methylammonium (CH3NH3) molecule, we extend the analysis to large single crystals of perovskite. The iodide, bromide, and chloride analogues were all prepared from solution via a seeded growth producing single crystals up to several millimeters in size. Thermal conductivities of these samples showed that single crystals exhibit a higher thermal conductivity than polycrystalline samples, and also a significantly different temperature dependence of thermal conductivity. These findings are useful both in that they point towards larger crystal domains as better heat conductors – a desirable quality from a photovoltaic module design standpoint – as well as paving the way for further understanding of the fundamental transport properties of these materials in terms of phonon scattering mechanisms.
Structure characteristics of expanded intumescent coatings, applied to structural steel for fire protection, have been studied using a computer tomography based analyses method. Laboratory-scale mass-loss cone tests have been conducted for measuring thermal performance of three types of coatings (type A, B and C) under three constant incident heat fluxes (25KW/m^2, 50KW/m^2 and 75KW/m^2). Micro-CT scanning technology was applied on intumesced samples to generate 3D reconstructed images by ImageJ software. By using an image processing technique, the central region of each scanned 3D model was divided into three layers in the vertical direction (top, middle and bottom layer). The coating morphologic structure was revealed and porosity distribution was analyzed. The structure characteristics under different heat fluxes were correlated with the thermal performance data obtained from the radiant cone exposure tests.
Copper redox flow batteries have been newly studied and offer many advantages over other redox flow battery chemistries [1-3]. There is little hydrogen evolution, no dendrite formation has been observed, and it is an all copper system which indicates no crossover contamination. Preliminary analysis indicates an open circuit voltage of 0.81 volts. Although the all copper redox flow battery has a relatively low open circuit voltage, the all copper redox flow batter provides a platform for a simple and cost-effective flow battery system. In this research, the all copper redox flow battery in bromide electrolyte has been studied in a prototype 6.45 cm² electrode single cell. Charge-discharge cycling achieved coulombic efficiencies over 85% and voltaic efficiencies greater than 75%. However, capacity fade was observed and preliminary results suggest this is due to metallic copper loss at the negative electrode. This is most likely due to non-ideal plating morphologies which have been studied independently as a function of current density and electrolyte composition. Cell design, cycling, and some fundamental analysis will be presented.

Abstract

Open-porous sponge structures of titanium and titanium-zirconium alloy were synthesized for the purpose of forming highly surface-enhanced electrodes. Pyro-metallurgical reduction of titanium and zirconium halides with solid/liquid magnesium was used in a pressure-controlled thermal retort chamber to achieve controlled Ti/Zr-halide + Mg ? Ti/Zr-sponge + Mg/Ca-halide conversion reactions to form nm-µm-porous Ti/Zr-alloy sheet. Coherent and mechanically robust sponge samples were obtained by sinter-bonding the Ti/Zr sponge particles and by removing the Mg/Ca-halide byproduct by pyro-vacuum distillation. Surface enhancement, i.e., the ratio of surface to volume of the sponges, could be adjusted by controlling reaction temperature and time. The process variables are listed in Table 1. Scanning electron microscope images show the morphology of synthesized Ti and Ti-Zr sponge samples. Composition analyses by X-ray diffraction show the alloys' chemical uniformity.
Over 500,000 women in the United States drink during pregnancy, and even low levels of prenatal alcohol exposure (PAE) can lead to birth defects, including craniofacial, neurodevelopmental, and congenital heart defects. Alcohol’s teratogenic properties interfere with an embryo's healthy development and can lead to the creation of reactive oxygen species. This results in increased oxidative stress, which contributes to development of birth defects associated with PAE. Previously we have studied the effects of a single binge-drinking episode on embryonic development using an avian model and optical coherence tomography imaging (OCT). OCT was chosen because of its advantages over serial sectioning and histology, such as rapid and consistent imaging that allows for immediate identification of complex and subtle cardiac abnormalities.

Typically, at late stages, alcohol-exposed avian embryos exhibit gross morphological defects in the chest wall, head, and eyes, as well as cardiac defects including smaller atrio-ventricular valves, smaller aortic vessel diameters, and thinner interventricular septae. Antioxidants have the ability to potentially reduce reactive oxygen species and prevent damage caused by high oxidative stress. Other studies in mouse models have shown that glutathione alleviates neurodevelopmental defects but the positive effects of glutathione supplementation on heart defects have not been investigated yet. Preliminary findings in our PAE model indicated that the addition of glutathione leads to an improvement in survival rates compared to ethanol only exposed embryos, as well as reduced defect rates of the head and body. Optimal doses of glutathione may also potentially prevent cardiac defects commonly seen after alcohol exposure. These results indicate that antioxidant supplementation can help prevent PAE-related defects which could significantly impact public health recommendations concerning prenatal nutrition.
Perylene diimide (PDI) is a small organic molecule that is studied extensively in organic electronics due to its high photochemical stability, high molar absorption coefficient, low cost, quantum yields near unity, and high charge carrier mobility. PDI molecules have the ability to self-assemble via \( \pi \)-\( \pi \) stacking in solution, forming nanostructures of highly ordered shapes and sizes. To this end we synthesize several asymmetrical PDI derivatives that incorporate a solubilizing chain at one imide position and functional groups with reactive handles at the other. Most research focuses on symmetrically substituted PDI derivatives that include long alkyl chains that provide solubility but are also insulating. Through our work we will use spectroscopy to study the effect this asymmetry has on the molecule’s stacking properties both in solution and the solid state. By adding functional groups at the imide positions we can control the size and shape of the PDI crystals without changing the electrical properties of the molecule. In addition, this desirable functionality provides the option to remove the protecting groups for further functionalization with p-type donors, to form an integrated electrically active material that can potentially provide a more uniform morphology in the active layer of solar cells and increase the efficiency of organic electronics.
Ethical implications behind CRISPR/Cas9 technology on reproductive primate research and human embryonic stem cells.

Since human embryos are so closely related to primate embryos (or chickens, bats, other mammals, etc.) why not take those embryos and alter it into a human embryo? From there you can derive stem cell lines, however, are you violating the principle/identity of the organism and of the human embryo?

CRISPR/Cas9 technology has revolutionized the world of gene editing. Since brought to light in the late 1980's it has greatly impacted the fields of genome engineering, disease models, and most recently human germline engineering. Save for a few states, we currently see that use of embryonic stem cell lines in research has been banned in the United States. The potential that can be unlocked using these stem cell lines with CRISPR/Cas9 technology is profound, with the ability to cure diseases and become a preventative treatment. Human embryos have much in common with other mammal embryos (i.e. fish, chickens etc.). Primates are the closest related species to humans on planet earth. With genetic differences accounting on average approximately 0.1%, primates serve as a pristine model for stem cell research (Smithsonian Institute). While there are no uniform international laws on CRISPR/Cas9 technology present with primates, there are great strives being made to use primates are model organisms and using stem cell lines from these organisms. However, since human embryos are so closely related to primate embryos (or chickens, bats, other mammals, etc.) why not take those embryos and alter it into a human embryo? From there you can derive stem cell lines that can be used for novel therapies. This is an alternative route that bypasses the current ban on human embryonic stem cell testing, by changing the origin of the embryo into another organism whose stem cell lines can be used for regenerative medicine etc. This however, raises many ethical questions in terms of the identity of the embryo and is it violating the principle/identity of the organism and of the human embryo?
In a quest to create a more holistic health care system, 10 coaches from Americorps work in hospitals with patients full time as volunteers. The coaches work in a variety of settings, including heart failure, sickle cell clinic, pediatrics, labor and delivery, stroke, orthopedics, inpatient psychiatry, and general primary care. The coaching method used was motivational interviewing. Motivational interviewing is a cognitive behavioral approach to fostering change from within individuals.

Objective:
The overall goal of the program is to guide patients to a healthier lifestyle. A case narrative is presented here to emphasize the benefits of health coaching.

Methods: I have personally coached more than 100 patients, primarily in neurosurgery inpatient settings. More than 26% reported goal success and 11% chose tobacco cessation as their focus. In this case study I present a brief narrative of one patient’s success in tobacco cessation.

Case Brief:
A female patient hospitalized for treatment of brain aneurysm had been advised to quit smoking. Her physician care team told her that her smoking would complicate her recovery. She had several grandchildren for whom she was primary caregiver. Thus, she identified her primary motivator for change as her ability to care for her grandchildren, and she talked about the value she placed on family. At the 30-day follow-up phone call, she indicated that she had successfully quit smoking. As a coach, my philosophy is that if accomplishing a goal is important to someone, they will find a way to do it. This patient embodied a mindset in which smoking cessation was aligned with her personal goal and ended up achieving her goal.

Discussion: The Americorps coaching program has had preliminary success in motivating patients to engage in healthy behaviors that they might not have otherwise engaged in. These healthy behaviors have benefits for individuals and the potential to reduce healthcare costs.
Current Research at the Center for Computational Imaging and Personalized Diagnostics

Our center develops novel computational biomedical imaging tools to assist and impact fields of diagnosis, prognosis, and treatment within a variety of diseases and cancers. In addition to developing new image analytics methods, we also study how different types of biomedical Big Data are related and can be combined with each other: from gene and protein expression to spectroscopy to digital pathology and to multi-parametric MRI.

Abstract

The Center of Computational Imaging and Personalized Diagnostics (CCIPD) at Case Western Reserve University is involved in various different aspects of developing, evaluating and applying novel quantitative image analysis, computer vision, signal processing, segmentation, multi-modal co-registration tools, pattern recognition, and machine learning tools for disease diagnosis, prognosis, and theragnosis in the context of breast, prostate, head and neck, and brain tumors as well as epilepsy and carotid plaque. Our group is also exploring the utility of these methods in studying correlations of disease markers across multiple scales, modalities, and functionalities -- from gene and protein expression to spectroscopy to digital pathology and to multi-parametric MRI.

We will present our research from over the last year, involving more innovative ways of quantitatively describing tumor morphology and subsequently building new predictors for distinguishing more from less aggressive disease phenotypes for a variety of pathologies including prostate cancer, breast cancer, oropharyngeal tumors, lung cancers, colorectal cancers, medulloblastomas, glioblastomas, and epilepsy. We continue to do more fundamental work on novel image fusion, segmentation, and registration techniques to allow for quantitative evaluation of new treatment modalities such as laser ablation therapy as also exploring the correlations between imaging, histopathologic, and molecular markers of disease response.
The anisotropic nature of FDM printed parts has limited its use to rapid prototyping. This study explored two ways to improve FDM’s weak mechanical properties along the build axis through ABS filament modification and UV post-curing. If successful, this will aid in converting the process from rapid prototyping to rapid manufacturing.

In Phase 1 of the project, ABS filament is modified via Friedel-Crafts acylation reaction to introduce photoactive sites for UV post-curing. One concern with this modification is the depth at which UV can penetrate the filament. To address this concern and also for comparison, Phase 2 of the project involves applying a thin coating of photoactive 4-allyloxybenzophenone on commercially available ABS filaments. It is expected that interlayer crosslinking will enhance the mechanical property of FDM-printed ABS parts. In the long run, this will aid in converting the process from rapid prototyping to rapid manufacturing.

Characterization techniques include FTIR spectroscopy to verify quality of synthesized compounds, thermal analyses using TGA and DSC to determine the proper processing temperature of modified filaments, tensile testing for mechanical property determination, and SEM for surface morphology and fracture analyses.
A prosthetic replacement can be considered after a tooth loss, but a precise amount of torque needs to be applied to the screw and upper abutment piece. This system ensures proper osseointegration with the jaw and avoids damaging the prosthetic. Existing manual torque wrenches use a bending-beam, breaking, or friction system to limit the applied torque. Our project focuses on modifying an existing beam torque wrench to allow for digital display of torque values as well as data collection and storage. Torque value is digitized based on the displacement of the wrench beam, which is accomplished by a sensor mounted to the stationary and beam portions of the wrench. The digital system allows greater precision and better data analysis for clinical uses.
The aim of this research project is to discuss the different types of contraceptives used around the world (North America, South America, Europe, Asia, and Africa), to analyze the primary biological reaction mechanism of oral contraceptives ("the pill"), to identify common side-effects, both physical and psychological, of oral contraceptives, and to determine how countries outside of the United States view adolescents and/or unmarried women taking oral contraceptives all through reviewing scholarly articles.
**Elevator Speech**

This research focuses on using fundamental iron chemistry to synthesize the backbone structures of natural products, which contain medicinal properties.

**Key Words**

- Organic chemistry
- Synthesis
- Iron
- Chemistry

**Abstract**

Diene-tricarbonyliron chemistry has found great utility in organic synthesis. One area of particular interest utilizes an iron-promoted ene-type reaction to facilitate spirocyclization or tandem double-cyclization when a pendant alkene or diene is available, respectively. Previously in the Pearson lab, spirocyclizations as well as double-cyclizations have been reported starting from compounds containing a heteroatom (O, S, NPh) within the tethered side chain. The work herein focuses on the preparation of cyclization products containing an all-carbon backbone. The intriguing aspect of this fundamental research is that synthesis of potential natural product-derivatives may be achieved, in particular those of the angular triquinane class.
Enterovirus 71 (EV71) is a major proponent of Hand Foot and Mouth disease, a disease that currently affects many living in Southeast Asia. Currently, there are no known vaccines for this potentially life-threatening illness. Understanding how this virus proliferates is critical to future vaccine and related drug development. Unlike most viruses, EV71 uses an Internal Ribosome Entry Site (IRES) and RNA mediated binding proteins called IRES Trans-Acting Factors (ITAFs) to translate its replicational and structural proteins. In an attempt to better understand how a portion of the EV71 IRES (specifically, stem loop six) interacts with a particular ITAF protein, hnRNP A1, portions of the two elements were purified and their binding was studied via an electrophoretic shift mobility assay (EMSA), tryptophan fluorescence, and isothermal titration calorimeter (ITC). The results show that SLVI successfully binds to one site on the UP1 domain of hnRNP A1 and that the protein undergoes a conformational change when bound. An 1H-1H nuclear Overhauser enhancement spectroscopy (NOESY) collected in water was also performed to confirm the secondary structure of SLVI.
Aims: To determine if sleep regularity is associated with success for pediatric participants of Healthy Kids Healthy Weights at UH Rainbow Babies and Children’s Hospital, a behavioral weight management program for overweight adolescents. Methods: Data was collected from 177 participants of adolescence age (13-18 years old; M = 14.58, SD = 1.36) who had attended the 12-week group weight management program. Sleep-based statistics were gathered for the sleep-based variables at baseline and at the subject’s last session of participation. Baseline sleep data were as follows: sleep duration (M = 8.27, SD = 1.02), sleep duration shift (M = 1.84, SD = 1.71), bedtime shift (M = 1.37, SD = 1.19), and wake-time shift (M = 3.21, SD = 1.68). Results: Baseline BMI-for-age percentiles were on average 98.90 (SD = 1.38, 90.90 to 99.94) with participants losing on average -0.823 kg (SD = 2.42, -8.90 to 6.00). Reduction in weight was most predicted by baseline bedtime shift (r = 0.142, p = 0.0592). However, weight loss was not predicted by baseline sleep duration, sleep duration shift, or wake-time shift (r = -0.03736 to 0.0313, p = 0.6216 to 0.9654). Conclusions: Change in weight data through participation of the program proved more useful in our analyses than change in BMI data. In this study, we expected success in the program when there were baseline regularities in the sleep pattern variables. Our findings demonstrated this, in that baseline bedtime shift was minimal compared with other measures (M = 1.37, SD = 1.19), and led to the most significant correlation in reduction of weight over the study’s period. Further research should be conducted to investigate if improved sleep regularity during participation facilitates greater success in pediatric weight management programs.
Development of Self-Healing Polymer for Stereolithography 3D Printing

3D printing of self-healing polymer (SHP) is a very new field of study in additive manufacturing. The success of this study will: 1) provide a potential avenue for allowing wider access of this polymer to the public via 3D printing and 2) use of this as a material in the manufacturing of products thereby would extend its product lifecycle and reduce waste due to damage early on in its product life.

Abstract
The study presents the viability of producing a self-healing polymer resin which can be used in 3D printing via stereolithography process. Currently, self-healing polymer (SHP) is considered as one of the key research areas in the field of study on polymers. However, most of the earlier studies on self-healing polymer have been using the traditional method or 2D manufacturing process. Furthermore, comparative analyses would be done to evaluate the thermo-mechanical properties of neat self-healing polymer vis-a-vis the 3D printed specimen of the SHP polymer. The 3D-printed self-healing polymer shall be subjected to NMR, FTIR, DSC, TGA and UTM. The study will synthesize boronic-ester-based material in the production of the self-healing polymer. Moreover, careful consideration and selection of the photoinitiator is critical as this will be used in the photopolymerization of the boronic-ester network for the formation of the self-healing polymer. Self-healing efficiency test shall be conducted to both the neat and 3D-printed polymer and comparison will be done to these specimens as part of the study. The success of the study will pave way for the advancement in the application of the self-healing polymer.
Abstract

The operational framework for printing three-dimensional nanocomposite hydrogel consisting of poly(ethylene glycol) and nanocellulose (specifically abaca nanocrystals) via stereolithography apparatus is presented. Poly(ethylene glycol) has been extensively studied due to its hydrophilicity and biocompatibility. However, this material lacks attractive mechanical properties that are required by many applications. Nanocrystals, known to be hydrophilic and biocompatible as well, exhibit inherent stiffness with a density of around 1.6 g/cm³ thus promoting their potential to provide high-performance reinforcement in polymeric composites. The combination appears to be promising because the strength of abaca nanocrystals can easily be incorporated into the polymeric matrix by suspending them in the cross-linked network. This mechanical reinforcement stems from the strong hydrogen bonds within and between the cellulose chains. It is expected that the current system will allow significant improvement in the mechanical properties of the conventional polyethylene glycol, which may be attributed to the uniquely efficient energy dissipation through the reversible interactions between the nanocrystals and the covalent cross-links of polyethylene glycol. One of the important considerations to attain optimum results, the dispersion of the nanocrystals is regarded to be homogeneous at concentrations below 1.5% v/v. Over this level, the nanoparticles tend to aggregate locally. Once achieved at optimum volume loading of nanocrystals, a good balance between elasticity and toughness likewise between fracture stress and fracture strain will strengthen the conventional polyethylene glycol hydrogel at least threefold. The experimental values of the modulus are believed to exceed the predicted moduli of Guth-Gold model simply to indicate assurance of notable enhancement.
### Abstract

Dengue infection is a fatal disease currently spreading in the tropical and subtropical countries. Because the illness has no known treatment, early diagnosis is very important to prevent fatal complications and severe conditions. The best diagnostic marker of dengue infection for early detection is the NS1 protein. Detection of NS1 protein will be made by incorporating two robust techniques – the molecular imprinting technology and quartz crystal microbalance. Because of the difficulty posed by using NS1 protein directly as the template, the strategy called epitope imprinting will be employed. Epitope imprinting is a strategy under molecular imprinting which uses a known portion of the original protein for imprinting. The basis of epitope imprinting is the natural interaction of antibody-antigen wherein the antibody detects the antigen using certain portions of the antigen alone. In this strategy, epitopes of NS1 protein will be imprinted onto the polymer matrix of terthiophene-3-carboxylic acid. The templates will be removed via potential washing using ACN as the washing solvent producing the desired molecular imprinted polymer (MIP) capable of detecting the epitope. Rebinding analysis will be conducted to test the concentration range at which the quartz crystal microbalance can detect the target epitope. It is expected that the signals for MIP rebinding analysis should be significantly higher than that for the non-imprinted polymer (NIP) rebinding analysis. All films will be characterized by AFM, XPS, and IR. The thickness will also be monitored using ellipsometry. If successful, the fabricated MIP film should be able to detect the original protein, which is the NS1 protein.
Distributed Intelligence and Robotics Laboratory (DIRL) will present several robots and autonomous systems, including OrigamiBots, InchBots, Philos, and TAG-Games.

Research in DIRL focuses on distributed intelligence, sensor networking, wearable sensing, and human-robot interaction, with a strong emphasis on how these systems can help and interact with humans.
Cyanate ester functional benzoxazine was synthesized for the first time. Differential scanning calorimetry (DSC) was used to examine the polymerization temperature which showed two distinct peaks corresponding to benzoxazine and cyanate ester. Kissinger’s and Ozawa’s methods were used to study the activation energies of the trimerization of cyanate ester and ring opening polymerization of benzoxazine. Observed DSC peaks were lower than report values of both benzoxazine and cyanate ester. Thermal properties like char yield and glass transition temperature were studied by dynamic mechanical analysis (DMA) and thermogravimetric analysis (TGA), and were found to be much better compared to conventional benzoxazine cyanate ester blends. Cyanate ester functional naphthoxazines was also synthesized with similar properties to Cyanate ester functional benzoxazine. The synthesis was done at room temperature, is less energy intensive, and has fewer reaction pathways. All of this makes the material more economical feasible.
Distant metastases cause >90% of cancer-related mortality. Patients suffering from osteosarcoma, where the typical route of spread is from bone to lung, are no exception. Despite the development of numerous treatment modalities targeting the primary tumor, 40% of patients still die from metastatic progression. Because of this, there is a pressing clinical need to determine the factors responsible for lung metastasis in osteosarcoma so that these factors can be exploited therapeutically.

Our lab discovered that epigenetic alterations at enhancer elements play a critical role in the transition of normal cells to malignant cells during tumorigenesis. More recently, the lab has gathered evidence that enhancer alterations also contribute to metastasis, specifically in osteosarcoma. Through epigenomic studies of non-metastatic and highly lung-metastatic osteosarcoma cell line pairs, combined with functional studies, our lab homed in on a gene, Tissue Factor III (F3), that appears to be a critical regulator of the metastatic process in osteosarcoma. The F3 locus is saturated with multiple active enhancer elements in metastatic cells, and these enhancers are almost completely absent in the non-metastatic cells. Through functional studies in vivo, we show that these enhancers switch on F3 as the metastatic cells engage the lung microenvironment. Remarkably, blocking the activation of F3 via shRNA dramatically impairs the ability of the cells to colonize and proliferate in the lungs. These findings, along with validation of F3 overexpression in human tumor samples, raise the possibility that F3 is a clinically relevant metastatic driver gene in osteosarcoma.
Abstract

MicroRNAs (miRNAs) have become prominent in gene therapy due to their ability to target multiple cancer-related genes. They are known to regulate gene expression by promoting or inhibiting gene translation. Specifically, we focus on the delivery of the miRNA-200 family in triple negative breast cancer (TNBC) due to its role in suppressing epithelial-to-mesenchymal transition (EMT). This study was designed to determine the effectiveness of delivering duplex and complementary miRNA sequences by looking at corresponding RNA and protein levels. miRNA was delivered using ECO, which is a pH-sensitive amphiphilic lipid carrier. The miRNA-200 sequences designed and used in this experiment were titled duplex and complementary sequences. Duplex sequences dramatically improve accuracy by sequencing both strands of each miRNA duplex, but they denature quickly as a result of their mismatched nucleotides. Conversely, complementary sequences are more stable than duplexes due to their perfect pairing. We show that depleted levels of the miRNA-200 family can be rescued through ectopic expression ECO nanoparticles. Re-expression of miRNA-200 allows for a reversal of EMT, as shown by the increase in E-cadherin and decrease of ZEB1 and ZEB2 mRNA and protein levels.
The first benzoxazine incorporating thiazole ring in its structure and its polymer have been synthesized. The structure of 2-aminothiazole based benzoxazine abbreviated as PH-thia was determined with nuclear magnetic resonance (NMR) spectroscopy. In investigating the differential scanning calorimetry (DSC) of it, it has been found that the benzoxazine moiety of it can polymerize. The thermal properties were tested with thermo gravimetric analysis (TGA) and dynamic mechanical analysis (DMA). In comparison with conventional polybenzoxazines, PH-thia was found to have excellent thermal properties such as a high char yield and high glass transition temperature. Due to the incorporation of the thermally stable heterocyclic ring, thiazole, poly (PH-thia) is expected to be a highly flame retardant polymer. The combination of benzoxazine and thiazole ring indicated unique behaviors in both its crosslinkage and properties, and it holds great promise for its potential in many applications which require high thermal resistance and flame retardancy such as aviation and construction.
This poster presents an investigation on the resonant frequency behavior of large-area, bulk-micromachined diaphragms made from silicon carbide thin films toward their potential use as mechanical elements in high sensitivity MEMS-based mass sensors. Test specimens consisted of single crystalline (100) 3C-SiC fabricated into 1 x 1 mm² diaphragms by anisotropic silicon etching. The diaphragms ranged in thickness from 125 nm to ~1.5 µm. Test specimens were excited into resonance using a vibrating PZT crystal and optical interferometry was used to detect the vibrational modes. Testing was performed in vacuum to eliminate air damping of the diaphragms. Static load-deflection testing was performed on select diaphragms to independently determine Young’s modulus and residual stress of the silicon carbide films. Resonant frequencies were measured between 50 kHz and 2 MHz. Diaphragms were excited over a range of drive amplitudes to determine the onset of duffing. Each diaphragm exhibited at least 50 resonant peaks, with at least one diaphragm having 250 peaks. Every diaphragm exhibited at least 5 peaks with quality factors (Q) > 10,000. The highest quality factor and the largest number of high Q peaks was observed in the diaphragm with the highest residual stress.

To investigate the utility of these diaphragms for mass sensor applications, a 60 nm-thick gold film was deposited onto a 1.5 µm-thick diaphragm in three distinct 20 nm-thick layers, each layer corresponding to an added mass of 384 ng. The fundamental resonant peak was measured after each deposition, shifting downward by nominally 20 kHz after each deposition. From these data, it was determined that the sensitivity of the diaphragm was 19.6 pg/Hz. Taking into account the spread of the resonant peak as well as the signal-to-noise ratio, it was determined that the minimum detectable mass of this diaphragm was ~4 ng, making it potentially well suited mechanically for use in mass-based single cell detection sensors.
The Prevention Research Center for Healthy Neighborhoods (PRCHN) is a highly responsive and collaborative research center that works with underserved and disadvantaged urban neighborhoods across Greater Cleveland to develop, test, and implement effective, scalable, and sustainable strategies to prevent and reduce chronic disease. Working together with public health agencies, community organizations, neighborhood leaders, and residents, the PRCHN seeks to accomplish its mission by addressing the broader social and environmental determinants inherent in the disinvested urban core. The PRCHN supports a comprehensive research agenda centered around community nutrition and food policy, tobacco prevention and control, environments supporting healthy eating and active living, and place-based health and behavior surveillance.

4 posters to be presented:

- Kakul Joshi MPH; Samantha Smith MA; Shari Bolen MD, MPH; Amanda Osborne M.Sc; Anna Thornton MPH; Briana Mcintosh MPH; Chelsea Hoch BS; Erika Hood M.Ed; Maleka Embry MPH; Michele Benko MS; Erika Trapl PhD Clinical-community partnership to promote fruit & vegetable consumption among food insecure patients with hypertension in safety net clinics.

- Liana Manuel, Department of Mathematics, Applied Mathematics and Statistics -Exploring Social Network Density Related to Food Habits among People Receiving Food Assistance Benefits

- Thornton, Anna and Lever, Jonathan “Implementing an Electronic Health Record Referral for Clinic to Community Linkage in Safety Net Clinics: Chronic Disease Self-Management

- Pike, Stephanie; Rouse, Chaturia; Freedman, Darcy; Trapl, Erika."Examining competing food options in an urban food desert"
Defects in the gene called cystic fibrosis transmembrane conductance regulator (CFTR) result in the systemic disease cystic fibrosis (CF). Although many of the clinical manifestations of CF are treatable, patients suffer from pulmonary infection and inflammation. The inability to manage infections indicates a possible defect in innate immunity. As demonstrated in previous studies, CFTR affects myeloid cell function and indicates that macrophage defects could contribute to the pathology of CF. Myeloid cells such as dendritic cells and macrophages are important contributors to both innate and adaptive immune responses through phagocytosis as well as antigen presentation respectively. Antigen presentation is mediated through the expression of MHC class II, which has been pursued as a genetic modifier of the CFTR protein and is associated with increased susceptibility to infection. A defect in MHC Class II receptors of macrophages could result in altered communication with T-cells and their subsequent activation in adaptive immune response. Using a mouse model, this project explores how CFTR affects macrophage function through modulation of MHC Class II. Macrophage response to bacterial analogs suggests that different MHC class II sequences impact cytokine expression and secretion in both CFTR-functioning and non-functioning macrophages. These conclusions will be used to provide insight into new therapeutic directions in CF.
Atherogenesis is accelerated by autocrine C3aR/C5aR signaling in both leukocytes and vascular endothelial cells

Abstract

The central role of the immune response and local complement in atherogenesis has been the subject of recent research. One important subset of these studies involves analyses of the roles of C3aR and C5aR, the G-Protein Coupled Receptors of anaphylatoxins C3a and C5a that are found in hematopoietic cell membranes. Previous research has indicated that these receptors are expressed the neointima. In support of their involvement, their C3a and C5a ligands can be detected in immunohistochemical preparations of atherosclerotic lesions, but not in normal vessel intima. Moreover, the genetic absence of C3aR and C5aR is associated with smaller lesion size and lower levels of proinflammatory cytokines. Our study has also implicated decay accelerating factor (DAF) knockout with increased atherosclerotic lesion sizes. We tested this by feeding the Paigen diet to C3aR-/-/C5aR-/-, WildType and DAF knockout mice for 16 weeks. Analysis of coronary artery tissues and blood plasma showed increased atherogenesis and associated symptoms in DAF knockout and WildType mice as compared to the C3aR and C5aR knockout mice.
Sufficient sleep and maintaining our circadian rhythm is an important component of our health. Recently we have shown that short sleep was associated with more aggressive breast cancer. Earlier studies have shown evidence that suggests that genetic variation in the circadian rhythm pathway is associated with an increased risk of cancer, including breast cancer. However, to our knowledge, there has not been any work regarding genetic variation in the circadian rhythm and risk for tumor grade, a standard marker of tumor aggressiveness. In this study, we investigated the relationship between single nucleotide polymorphisms (SNPs) in the CLOCK gene and tumor grade. One SNP, rs11133391 had a significant association with tumor grade, in which having one or more C alleles, increases the risk for grade 3 tumor.
Abstract

Polymers, large chemical compounds made up of repeating monomer units, serve many roles in our daily lives and are ubiquitous in the modern world- from containers for our food, to protection in our cars, to medical implants and surgical tools. While decades of research in science and engineering have yielded a plethora of chemical structures of polymers and an understanding of their formation and structure-property relationships, now polymers must be developed to address current limitations. To expand the applications of polymers, discover new uses, and address concerns of their limitations, new monomers must be investigated and developed. This work describes the development of silyl ketenes as a new group of compounds for use as monomers. We will describe the synthesis of silyl ketenes, and report their reactivity and polymerization under different conditions. The results of this study have the potential to transform the chemical community’s understanding of how to develop new monomers, as well as yield novel polymeric structures with distinct and unique properties.
Objective: This study examined if Cleveland neighborhood residents’ definitions of child abuse and neglect varied over a 20-year period, and if their definitions varied by gender and race.

Methods: Following a similar protocol from a 1995 study, 400 participants were recruited from 20 Cleveland neighborhoods that varied in rates of reported child maltreatment. During an interview, participants provided behaviors they considered child abuse and neglect. Responses were categorized using the same classification scheme of specific behaviors and five summary categories developed for the 1995 study. Frequencies and rank order of summary categories and specific behaviors in 2015 were compared to results from 1995. Chi-Square tests examined gender and race differences.

Results: Comparison of summary categories over time showed that neglect overtook physical abuse as the most frequently identified behavior. Frequencies and rank order of inadequate supervision, emotional/verbal abuse, sexual abuse, and parental misbehavior remained fairly consistent. Rankings of specific behaviors also remained fairly consistent over time. However, three lower-ranked actions in 1995 – hitting child with object, leaving mark on child, and insufficient clothing – made the top-ten ranking in 2015. At both time points, more European-Americans than African-Americans identified physical abuse and parents’ misbehavior as abuse and neglect, while more African-Americans identified sexual abuse in 2015 only. No gender differences were observed.

Conclusion: Overall, definitions of child maltreatment from 1995 and 2015 were consistent, but not uniform. Programs addressing maltreatment should consider similarities along with new-found differences in these definitions to ensure policies and programs are reformed according to current views.
Hyperthermia, overheating, and heat stroke are common conditions that have long been faced by a multitude of people for a variety of reasons. From athletes competing in the summer Olympics, to industrial steel mill and forge workers to MS patients, to the everyday ordinary person, thermoregulation is a pervasive concern in daily health. Many pregnant women experience discomfort associated with heat at various points during their pregnancy. Basal Body Temperature (BBT) actually rises by up to a degree during ovulation, and women’s temperatures tend to stay elevated until about the 5th month of pregnancy. Fluctuations in hormones can also cause hot flashes. Over 75% of pregnant experience these hot flashes. This can cause discomfort, especially for summer pregnancies. In addition, high temperatures may also have deleterious effects on developing fetus, depending on the duration of the exposure and period of gestation. From several different animal studies, it was found that maternal hyperthermia could lead to defects in the neural tube, craniofacial related defects, microencephaly, as well as miscarriage in the early stages of development. During the later stages of development, exposure to high temperatures have been linked to defects in the central nervous system (CNS), low birth weight, and preterm births. Low IQ and behavioral problems have also been associated with maternal hyperthermia. The goal of this design project was to develop an affordable, effective, and convenient cooling vest, based on the use of electrolytic gel packs, which can be worn to mitigate the risk of hyperthermia for the user for up to 2 hours while performing daily activities outside of air conditioned environments such as walking, shopping, or driving.
A long literature review has shown that chronic alcohol abuse results in brain impairment especially in U.S. college binge drinkers. Participants were administered the Flanker Task to gauge attentional effects from binge drinking and depression. The results were drawn from error/non-error responses as well as EEG responses in the frontal cortex. What is expected from these results is that heavy drinking and low reappraisal will show lower response levels on errors on the frontal N2 response.
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**Title** | Medical Instruments for Nations in Development

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<td>Elevator Speech</td>
<td>MIND, Medical Instrumentation for Nations under Development, helps repair and test used medical equipment that is being sent for use in developing countries. MIND repairs the equipment for Medwish International, a Cleveland based organization. For the first time, MIND will be designing medical equipment specifically for developing countries. MIND provides a great opportunity for hands on experience with medical equipment for BME, Premeds, or anyone who is interested. MIND is open to anyone who wants to join.</td>
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| Key Words | Medical Instrumentation, Community Service |

**Abstract**

MIND, Medical Instrumentation for Nations under Development, helps repair and test used medical equipment that is being sent for use in developing countries. MIND repairs the equipment for Medwish International, a Cleveland based organization. For the first time, MIND will be designing medical equipment specifically for developing countries. MIND provides a great opportunity for hands on experience with medical equipment for BME, Premeds, or anyone who is interested. MIND is open to anyone who wants to join.
A primary mission of zoos and aquariums is to inspire a feeling of connectedness to nature and motivate actions that support long-term survival of healthy ecosystems. Cleveland Metroparks Zoo has recently developed a new landing page to help raise awareness of the Zoo's international conservation programs and the conservation issues affecting wildlife living in nature around the world. To make it easy for visitors to find, the Zoo has created a ghost url of "www.futureforwildlife.org" that will be used on interpretive graphics as a gateway for additional information and opportunities to take action. The Zoo is testing, creating, and testing again a series of interpretive graphics aimed first at increasing awareness and second at increasing action. In 2016, Zoo staff will create four new conservation graphics with the goal of increasing awareness of the Zoo's wildlife conservation efforts. This Capstone project is aimed at identifying successful characteristics of flat sign prototypes that will increase visitor awareness of the Zoo's conservation efforts and determine the best approach for compelling visitors to access the Zoo's conservation web page via the ghost URL. The second phase of this study will take place in 2017, when Zoo staff will develop six new graphics aimed at taking visitor action from simply accessing the web content to taking the next step of taking action for conservation by donating money, signing a pledge, or serving as a wildlife advocate via social media.
Notch and Hypoxia Inducible Factor Contribute to Endothelial Cell Behavior

We looked at important signaling processes that occur during vessel and tumor formation. We hypothesized that the processes (Notch, Vascular Endothelial Growth Factor, and Hypoxia Inducible Factor) crosstalk among each other and that low oxygen levels encourage cell growth by manipulating this crosstalk.

Key Words
- Hypoxia
- Notch
- Cell sprouting

Abstract

In response to hypoxic (low O2) conditions, tissues must develop the necessary vasculature in order to survive. During embryonic development and in pathologies, such as wound healing and tumorigenesis, the Hypoxia Inducible Factor (HIF) is responsible for transducing transcriptional responses essential for these events. Notch and Vascular Endothelial Growth Factor (VEGF) have major roles in facilitating the proper initial sprouting of vessels. In addition, in response to hypoxia, HIF-? can dimerize and stabilize the transcriptionally active intracellular cleaved Notch receptor, Notch intracellular domain (NICD). We hypothesize that hypoxia induces this molecular signature responsible for the transcriptional expression for genes associated with sprouting and thereby promoting the emergence of endothelial sprouts. We utilized a mouse endothelial cell line (MS1) to analyze the molecular and biological effects of hypoxia and Notch on sprouting. First, we show by RT-qPCR that hypoxia alters the expression of genes involved in Notch and VEGF pathways. Specifically our data shows upregulation of the downstream Notch targets genes Hrt1, Hrt2, Vegf and its receptors Flk1 and Flt1. Inhibiting ?-secretase activity with DAPT to prevent the makeup NICD, we detected changes in both gene expression and cell sprouting. Most interestingly, our data shows that while hypoxia induced the expression of the Notch ligand associated with endothelial sprouts (Delta-4, Dll4) DAPT treatment inhibited its transcription. To quantify sprouting angiogenesis, we established a biological system in which MS1 cell aggregates are cultured in a fibrin matrix. Our results show that hypoxia promoted sprouting angiogenesis independent of Notch signaling. This project is elucidating novel converging molecular pathways influencing angiogenic cell function and behavior, which can lead to novel therapeutic discoveries for the treatment of vascular diseases.
**Title**: Computational Modeling of Cell Blebbing

**Elevator Speech**: Various carcinoma cells, such as Leukemia, use bleb-based methods of motion. By developing better models of blebs and bleb-based motion, we can better predict and understand this method of cellular transport, which will aid us in studying the spread of these carcinoma cells.

**Abstract**: Blebs are protrusions the cell membrane that are formed by hydraulic pressure. Cells have been observed using blebs to move, using adhesion to a substrate or extra-cellular matrix. Various carcinoma cells are known to utilize bleb-based motion. Understanding blebs and bleb-based motion may have implications for public health. In this project, we investigate different models of cell membrane elasticity in the case of blebbing, where the structure is dynamic. We developed numerical models of cell membrane elasticity, with an emphasis on modeling cellular blebs. We also explored different models and numerical methods to characterize the elastic response of the cell membrane.
Aquaporin 1 (AQP1) promoters assemble as homotetramers. Each protomer has a water selective pore at its center—the aquapore—that controls the water permeability of the plasma membrane. The central-pore of the tetramer is not permeable to water and is instead hypothesized to be permeable to the gas, CO2. The Boron laboratory previously demonstrated that the central pore of human aquaporin 5 (AQP5) was important for CO2 permeability (Qin & Boron, 2010) and that, the major extracellular-side barrier for CO2 through the central-pore could be at or near the residue T41 (Qin & Boron, 2011). Comparing sequence and structural alignments of human AQP1 and AQP5 determined that D48 in AQP1 resides in the equivalent location to T41 in AQP5. We created D48A and D48F mutants via site-directed mutagenesis in AQP1. Similar to the work previously performed in AQP5, we determined the functional impact of each mutation. We compared the osmotic water permeability (Pf) of each AQP1 mutant by monitoring cell swelling under hypotonic conditions. We expressed wild-type (WT) AQP1 and the mutants in Xenopus leavis oocytes. Following transfer into hypotonic solution we recorded the changes in Pf with respect to WT AQP1. We next measured \( \Delta p_{HS} \) in oocytes exposed to 5% CO2/ 33mM HCO3\(^-\) compared to WT-AQP1 controls and compared the magnitude of the \( \Delta p_{HS} \) transient from oocytes expressing the D48A and D48F mutants with that from WT expressing oocytes. In all experiments we used a surface biotinylation assay to normalize data for surface expression of the WT and mutant AQP1. We conclude that mutating the D48 residue can significantly alter CO2 permeability of AQP1 with no effect on water permeability, and it must therefore reside at or near the major extracellular-side barrier for CO2 transport.
UMBILICAL CORD TISSUE DERIVED MESENCHYMYAL STEM CELLS: THERAPEUTIC DEVELOPMENT FOR CYSTIC FIBROSIS.

Introduction: Cystic Fibrosis (CF) patients die due to pulmonary infection and inflammation, which has been the focus of human mesenchymal stem cell (hMSCs) therapeutics. hMSCs can be derived from umbilical cord tissue (HCT) which is discarded post-delivery. HCT hMSCs were evaluated for therapeutic potential. Methods: Cord Blood Registry® provided HCT hMSCs. hMSCs were cultured with or without lipopolysaccharide (LPS) or peptidoglycan (PEP) for 2 or 24 hours. hMSC supernatants were analyzed for secreted cytokines by Luminex (mean±SEM pg/ml) and cells analyzed for gene expression by RT-PCR (mean±SEM, change in cycle threshold, ?CT). hMSCs functional activity was measured using Staphylococcus aureus (SA) and Pseudomonas aeruginosa (PA) for antimicrobial activity (colony forming units, CFUs) or anti-inflammatory activity by adenosine triphosphate (ATP) relative luminescence units (RFUs) using A549 epithelial cells. Statistical analysis was done with GraphPad Prism6. Results: HCT hMSCs secreted MIP-1? (45±23 pg/ml), IL-6 (95,339±81,389 pg/ml), TNF? (9.4±1.2 pg/ml), IL-1? (2616±1316.49 pg/ml), and IL-8 (93,147±13,684) (n=3, p?0.05). LPS stimulation increased IL-6 and MIP-1? (121940±108,003 pg/ml and 50±26 pg/ml respectively, (n=3, p?0.05). hMSC expressed IL-6 and IL-8 mRNA (-3.89±2.52 and -2.15±3.42 respectively) which did not change with LPS. PEP stimulation increased both IL-6 and IL-8 mRNA synthesis (-6.76±1.5 and -5.93±2.71 respectively). Functionally, HCT hMSC supernatants were antimicrobial against both PA and SA decreasing CFUs from 37 to 28.5 and 72.5 to 19.5 respectively. Further, the hMSCs supernatants had anti-inflammatory activity, which was enhanced by LPS (86,655±5725 RFUs to 115,770±1879 respectively, p?0.05). Conclusions: HCT hMSCs have the potential to provide anti-microbial and anti-inflammatory therapy.
Individuals constantly must decide whether to explore or exploit their environment. This is critical to most decisions we make. This study examines how emotions can influence these decisions at the most basic level.

To test this hypothesis, we ran 41 participants through a computerized task which asked them to select one of two doors, sometimes revealing a rewarding “point”. A point sat behind the “better” door 75 percent of the time, and the “worse” door 25 percent of the time. After 60 trials, participants were shown an image before the door choice was presented in each of the next 10 trials (except in a control group of 12 individuals who were shown no images). 12 participants saw sadness-evoking images, 9 saw fear evoking images, and 8 saw neutral images for another control. Images were not shown in the final 30 trials.

The number of times the better door was selected in the 10 treatment rounds was compared to the number selected in the 10 rounds prior and post treatment. Change in the percentage of the time spent exploiting was only significant in the neutral image group. We found no significant relationship between discrete emotions expression and modification of exploiting behaviors. However, we do feel further exploration of this topic is needed due to the lack of power in this analysis.
The stress of birth is a common concern for expectant mothers. Researchers suggest this stress can be eased with antenatal class education while it is exacerbated by class non-attendance. Working with the Teen Parents Support Programme of Galway (TPSP), Ireland, and the Antenatal Clinic (ANC) at University Hospital Galway, Ireland, the primary concern for midwives was antenatal class attendance. By not attending classes, pregnant women miss information about topics such as pain management and the signs of labor, as well as having a tour of the labor and delivery unit.

This project focused on producing an informational video and filming a virtual tour of the labor and delivery unit in collaboration with the midwives at both organizations. The target audience was teenaged and adult mothers-to-be. The goal of the project was to improve patient outreach and fulfill the needs of the non-attending expectant mothers. A literature review and meetings with key stakeholders identified the salient content to be included. Content included information on antenatal classes, when to attend the hospital during labor, the birthing process, and information on postnatal recovery. It also included photographs and videos of the labor ward to familiarize the mothers with the unit. Content was reviewed by midwives to ensure it was appropriate for the target audience. The midwives guided and evaluated the project throughout the process. Final evaluation was very positive and the final product will be posted on the TPSP and ANC websites as a resource for pregnant women.
#KONY2012: a Critical Analysis of Outside Interventions and Internet-based Activism in Uganda

This review addresses the importance of cultural context in aid projects. In trying to “make Uganda a better place,” the Kony 2012 campaign by the non-governmental organization Invisible Children took the voice from the Ugandan people. We must learn how to have a positive impact on platforms of internet activism.

Invisible Children’s Kony 2012 campaign and their 30 minute documentary released in March of 2012 took the world by storm. The campaign raised millions of dollars and in the first eight days the video hit more than 90 million views on YouTube, making it one of the fastest-spreading videos in the website’s history (Pew Research Center). This online campaign sparked immediate and widespread discussion about how to intervene in the Ugandan conflict and “stop” the atrocities committed by Joseph Kony and the Lord’s Resistance Army. Following an initial positive response, Invisible Children’s campaign and its call for action became the subjects of media scrutiny and widespread criticism from researchers and civil society organizations connected to Uganda. This paper will use an anthropological approach to development and internet-based social activism in order to analyze critically the initiatives of Invisible Children, their social media call for action in Uganda, and the online video on which this campaign was based, as well as some of the responses and criticisms generated by this campaign.
Abstract

There is a large problem with safe and proper medical waste disposal in Uganda. Medical waste is often burned in pits, leading to personal and environmental harm. The conditions within the garbage pits are not sufficient to fully sterilize and degrade medical waste and dangerous products are left in pits that people scavenge in. Because of this, we are developing a product that creates an efficient way to store and sterilize medical waste that is created with the use of needles. Every health care worker will carry a hand held device that contains a cutting mechanism. After using a syringe, the device will allow them to cut off the metal tip and have it stored inside the capsule. The capsule can be used to cut and collect hundreds of syringes tips. Once the device is full, the worker can place it within an incinerator that is found in the health center. After being transferred to the incinerator, an electric circuit will create a current that will degrade the needles, sterilizing the waste in the process. The user will be left with a block of sterilized, solidified metal. One incinerator will be installed per health center and each health worker will be given a capsule, allowing them to work remotely for an extended period before having to empty their capsule. When fully developed, this device will prevent syringes from being discarded and burned in pits, reducing the chance that a person could stick themselves and have body fluids or unintended medication injected into them.
Title: Comparing the infectious mechanisms of SARS, MRSA, and C. diff and the differences between their diagnoses and treatment options

Abstract

Disease causing agents can be found almost everywhere in our communities, and this prevalence means that healthcare providers should be aware of the many disease causing agents. This awareness will allow them to treat patients more effectively and to educate the general public. To demonstrate how much variation there is between disease agents and why they are all equally important to know about in the healthcare field, I did a case study of three different diseases: SARS, MRSA, and CDI. Severe acute respiratory syndrome (SARS) first presented in the Guangdong Province of China in 2002. Fortunately, many organizations worked tirelessly to identify the disease agent to be a novel coronavirus. Steroid treatments were effective against SARS, but after the outbreak groups continued to work on vaccines for the disease. Another disease that has caught the public’s attention is methicillin-resistant Staphylococcus aureus (MRSA). Before this disease was thought of only happening in healthcare settings, but recent community outbreaks have given people concern. Researchers are looking at a new antibiotic to replace the standard treatment, vancomycin. Clostridium difficile or C. diff is the agent for the hospital acquired disease known as Clostridium difficile infection or CDI. The disease is usually caused when a patient receives an antibiotic treatment, which then wipes out the normal gut flora. The naturally occurring C. diff then takes over and causes a disease state. Commercial diagnostic methods have been developed as cost effective ways of detecting for C. diff. Innovative treatment options have come about to oppose the traditional medicinal approach such as fecal transplants, while other groups are looking into bacteriophages. Being acquainted with different diseases should help medical professionals to identify diseases earlier, treat them more effectively and to help educate the public about prevention measures.
Abstract

Gecko-inspired structured adhesives will be valuable for novel climbing and space robots. Robots also provide useful evaluation platforms for these adhesives. Climbing robots need to be lightweight, and thus many designs use multiple feet on a single rotating wheel-leg. Generally, such designs have not been able to walk robustly on steeper than vertical substrates. In this work, we use an improved version of our previous Mushroom-Shaped Adhesive MicroStructured (MSAMS) tape to support a power-autonomous robot reliably walking inverted on glass ceilings. The resulting speeds are greater than one body/length per second, faster than other adhesion-based climbing prototypes. The printed robot design is also a contribution toward future robotic designs and will have future applications in testing new adhesives for robotic feet.
President Barack Obama declared the West African Ebola outbreak a national security priority in September 2014, prior to Ebola diagnosis within the United States. The characterization of disease outbreak as a national security priority lies outside the traditional Department of Defense definition of national security, which emphasizes the strength and health of the military. Non-military aspects of national security, such as political and economic stability, are readily undermined by devastating infectious disease outbreaks. The high percentage of deaths among individuals infected with Ebola threatens the stability of the populations it infects; however, the nature of its transmission, through direct contact with infected bodily fluids, makes it incredibly difficult to contract. Global airline networks, which allow people from all countries to travel nearly anywhere in the world in 24 hours, have facilitated the global spread of otherwise contained infectious disease. Global air travel facilitated the arrival of Ebola in the United States, when an individual travelling from Liberia was diagnosed with Ebola in an insufficiently prepared hospital in Dallas, TX. Furthermore, an infected woman travelled from Dallas, to Cleveland, and back to Dallas after treating the first Ebola patient and prior to her own diagnosis. This study seeks to utilize the United States Ebola cluster as a framework to evaluate airline vulnerabilities that made the 2014 West African Ebola outbreak a national security priority to the United States.
Abstract

Usher syndrome type III, characterized by progressive deaf-blindness, is caused by mutations in the human Clarin-1 gene. No treatment is available to preserve hearing or vision in Usher Syndrome III patients. The laboratory mouse is a preferred model to investigate the role of specific genes in hearing and deafness. Further, the mouse can be used as a preclinical model to investigate therapies for specific monogenic disorders, such as Usher Syndrome III. Mice carrying the knockout mutation in the Clarin-1 gene are deaf, and this phenotype is associated with degeneration of the mechanosensory ‘hair’ cells in the cochlea. The knockout mice suggest that the hearing loss in Usher Syndrome III patients is due to loss of hair cells. We hypothesize that we can prevent hearing loss associated with the Clarin-1 mutation if we can prevent hair cell loss in Usher Syndrome III subjects. The goal of the lab is to find therapies for Usher Syndrome III sensory disorder. Mice carrying Clarin-1 with a specific Usher Syndrome III mutation, such as Clarin-1 N48K, are generated. The ‘humanized’ animal model is used to screen for therapeutic agents to mitigate the effects of the Clarin-1 N48K mutation. However, before proceeding with the therapeutic screening, we first have to determine whether Clarin-1 can substitute or serve as a surrogate for Clarin-1 in the mouse. If hair cells and hearing are rescued in the knockout mice carrying the Clarin-1 in the form of a transgene, we can conclude that Clarin-1 has the same function and is a true ortholog. This also means that knockout mice harboring Clarin-1 N48K can be used as preclinical models to screen for therapeutic agents that can mitigate the pathogenic effects of the Clarin-1 N48K mutation. My work focused on using polymerase chain reaction and gel electrophoresis to distinguish (genotype) mice carrying normal or the knockout allele of Clarin-1 and those that carried a copy of the transgene. Cochleae from mice with the appropriate genotype were dissected and examined to measure the phenotype-genotype correlation between hearing rescue and hair cell survival. Here, I share the results and my experience in a research lab at Case Western Reserve University during the summer of 2015.
This study explores the possibility of different responses to the recognition of paintings versus words in the context of memory. Previous research has suggested that subjects are more conservative with their recognition of paintings than with their recognition of words. A memory study was conducted in which subjects were shown a series of paintings and words concurrently. Subjects were then shown a new test series wherein they had to decide whether they had seen the individual stimuli in the previous series or not. The results of the memory test showed that there was no significant difference between willingness to positively respond to paintings and words. However, there was a significant difference in accuracy. Subjects were more likely to correctly identify paintings than words. Although it is concluded that the original hypothesis was not supported in this study, the difference in accuracy suggests that memory may behave differently for subjects depending on what kind of stimuli are used for testing.
Investigation of the mechanism of hyperammonemia in 3-hydroxypropionic acidemia, using a rodent and a perfused liver model.

This project investigates the mechanism of hyperammonemia in the human disease 3-hydroxypropionic acidemia using a live rodent liver model. Propionic acidemia is an inborn autosomal recessive disease, where infants are deficient in propionyl-CoA carboxylase. This results in the buildup of toxic metabolites ammonia and 3-hydroxypropionate (HPA). The current treatment for propionic acidemia is mostly based on low protein diets because protein catabolism releases ammonia. Accumulation of ammonia downstream caused the secondary defect in the urea cycle, but the exact mechanism in which ammonia inhibits the urea synthesis is not clear. This project uses metabolomics technique to investigate the hypothesis of 3-hydroxypropionate and propionate on the urea synthesis in the normal rat liver, which are divided into groups of various concentrations of HPA and propionate. Based on the preliminary data, we concluded that propionate does not lower the maximum potential of the urea cycle. The urea cycle still has a complete cycle turnover rate, even with lower urea cycle intermediates levels. This could be attributed to the high enzyme’s capacity to shift the cycle forward.
Urbanization and forest fragmentation has led to bat population declines worldwide. Bats utilize various land type habitats, though it remains unclear how they react to land use changes associated with urbanization. Identifying bat foraging areas is an important indicator for monitoring populations and habitat use. Our study uses mobile acoustic surveys to investigate the distribution of bat activity in the Northern District of the Cherokee National Forest (CNF) in eastern Tennessee. We conducted nine driving acoustic survey transects (~30 miles each) from June-early August 2014-2015. Transects were surveyed twice per year. Call files were recorded using Anabat SD2s, with the microphone pointed straight up at a 0° angle on top of the vehicle, while driving 20 mph. We analyzed calls to phonic level and species level using conservative parameters on BCID (v2.7c). The calls were mapped and layered in/near different land types and then we measured distances to different land use areas using GIS. The three most prevalent land use types in this study area are low to high-intensity developed land, forest, and pasture hay.

Overall, identified calls were proportionally higher in forested areas than in any other land type. The number of calls recorded in developed land was equivalent to the number of developed sites visited. Myotis calls were more frequent in forested areas than low-frequency calls. Myotis calls were also less frequent and further from developed land, especially high-intensity developed land. We plan to compare call activity at individual transects, as the north end of the study site is more fragmented and developed than the southern end. We aim to better understand how land use affects bat distribution. With increasing urbanization and changing forest shapes, understanding land use preferences for various, and especially endangered species, is important for bat conservation and management.
Green tea polyphenols (GTP) have demonstrated anticancer effects through reactivation of epigenetically silenced genes in cancer cells. The DOC-2/DAB2 interactive protein, DAB2IP, is a tumor suppressor and an important member of the RasGTPase-activating protein family, with distinct cellular functions that suppress cell proliferation, invasion, and metastasis. DAB2IP has been found to be significantly down-regulated in several different kinds of human cancer. In prostate cancer, reduced DAB2IP expression is observed in various human cancer cell lines and its loss correlates with poor prognosis in cancer patients. Studies indicate that reduced DAB2IP in prostate cancer is due to alteration in epigenetic mechanisms. We investigated whether GTP has the potential to induce DAB2IP expression in prostate cancer cells. Treatment of human prostate cancer DU145 and PC-3 cells with 10-40 μg/ml of GTP for 24 and 48 hours resulted in a dose- and time-dependent increase in DAB2IP expression both at the protein and messenger level. GTP treatment causes reduced expression of Ezh2, a histone methyl transferase subunit of a Polycomb repressor complex along with a decrease in H3K27me3 in both cell lines. These alterations were consistent with reduced migration and invasiveness in both cell lines. In vitro experiments showed that DAB2IP transcription was restored following treatment with 5-aza-2'-deoxycytidine, an inhibitor of DNA methyltransferase; trichostatin A, a class I histone deacetylase inhibitor and a combination of the two all negatively correlated with the invasive potential of prostate cancer cells. Our findings, for the first time, provide evidence that GTP has potential to induce DAB2IP expression through epigenetic modifications.

The inverse association of DAB2IP expression with Ezh2 raises the intriguing possibility that reactivation of DAB2IP expression with green tea polyphenols may represent a potential therapeutic strategy for the treatment of prostate cancer.
Abstract

Migraine is a debilitating unilateral headache that affects approximately 10% of people worldwide. However, the exact mechanism underlying migraine is unknown. The headache is associated with photophobia, phonophobia, nausea, and sometimes a visual disturbance called aura. Vascular theory and cortical spreading depression (CSD) theory have been proposed to describe the source of the headache. Vascular theory suggests the pain is caused by dilation of meningeal blood vessels, leading to irritation of perivascular projections of the trigeminal nerve, whereas CSD theory suggests that the headache is caused by the sensitization of trigeminal neurons via the release of ions and neurotransmitters. Because vascular changes occur during CSD, the two theories are not mutually exclusive. The calcitonin gene-related peptide (CGRP) is a neuropeptide created by alternative splicing of the calcitonin gene that has been implicated in migraine headache. CGRP is a vasodilator and a nociceptive peptide, thus it may play a role in both theories.

The goal of this research project was to evaluate the progress of migraine research in elucidating migraine headache etiology. Primary research articles on migraine were analyzed, with focus on advances within the past 20 years. The present research elaborates on the two main theories, vascular and CSD theory, detailing their discovery and subsequent history before describing contemporary findings on their role in migraine pain. In addition, the potential involvement of CGRP in both theories is considered. Several clinical trials were evaluated to determine the efficacy of various CGRP receptor antagonists as migraine treatments. The results suggest that CGRP antibodies are a clinically valuable migraine treatment. Challenges that remain in understanding and treating migraine headache include the heterogeneity of symptom expression among patients and the impermeability of the blood brain barrier.
Our group is making efforts to improve usability of the CoaguChek® XS device. Rapid prototypes were created based on user specification in terms of outer shell shape, weight distribution, as well as button properties and placement to enhance intuition of device operation. This usability centered design will improve device operation.

Anticoagulants are widely used to prevent and treat blood clots which can contribute to heart attacks, thromboembolic strokes, and venous thromboembolisms. Individuals on anticoagulants, like Coumadin, require regular testing to measure their international normalized ratio (INR). This is necessary to ensure patients are taking a therapeutic dose to balance the risks of thrombolysis and hemorrhaging. To address this, anticoagulation clinics utilize blood tests for monitoring Coumadin levels. This presents various barriers to patients including distance from a clinic, limited patient mobility, and requires professionals to evaluate the results. Therefore, there is a need for a portable Point-of-Care Testing (POCT) device for Coumadin home monitoring. CoaguChek® XS is a commercially available portable POCT Coumadin monitoring device. This device allows monitoring without professional assistance. However, this device is not widely used by patients. According to the FDA, one main source of error is inadequate operator training. Inadequate operation of the system could lead to false INR readings resulting in adverse events. This lack of comprehension stems from inefficient engineering design and unclear component functionality such as buttons and test strips.

Our group has engineered a device design to address this inadequate operator training. We performed a usability survey of the current CoaguChek® XS device and received important feedback that can contribute to the improvement of current home Coumadin monitoring devices. In this poster, we will address usability parameters and how it can enhance the operation of the device.
A proper understanding of how natural disturbances, anthropogenic disturbances, and climate change affect mangrove ecology will allow governments to implement effective mangrove conservation programs, which will allow the maintenance of high species biodiversity within mangrove habitats, the continual removal of wastes from estuarine systems, and the protection of coastal habitats.

Abstract

Mangroves inhabit a variety of land habitats throughout the world such as riverbanks, fishponds, canals, reefs, lagoons, and coastal habitats. Within each of these habitats, mangroves play key roles in the ecosystem. For example, mangroves provide food and shelter for various birds, insects, epibionts, mammals, reptiles, fish, epifaunal species, and infaunal species. In addition, mangroves found within estuarine systems are able to remove nutrients, heavy metals, and organic pollutants from wastewater. Lastly, coastal mangroves provide a great deal of protection for inland species by attenuating waves and winds in the event of a storm. Since mangroves are beneficial to such a large number of species, it is necessary to address the negative and positive impacts of natural disturbances, anthropogenic disturbances, and climate change upon mangrove populations. For instance, cyclones reduce mangrove population growth rates via soil erosion and propagule reduction, the anthropogenic exploitation of mangroves for fuel wood and the establishment of residential areas has led to widespread mangrove deforestation, and rises in sea level due to climate change have led to the overexpansion of mangroves into salt marshes. Therefore, it is essential that a proper understanding of these impacts be developed so that governments can implement programs and policies to protect mangrove populations without allowing their overexpansion. A few possibilities include spreading public awareness about the necessity of mangroves, increasing the cost of purchase of mangrove habitats, and rehabilitating degraded mangrove sites.
New South American native ungulates (Litopterna: Macraucheniidae) from the middle Miocene (Seravallian Age) of Quebrada Honda, Bolivia

Understanding the diversity of this long-lived family can help illustrate the geological, climatic, and environmental changes that occurred in South America throughout the Cenozoic. By understanding these changes and how the flora and fauna reacted to them, we may better understand the impacts of these changes in our own time.

The Macraucheniidae are a diverse and long-lived family of native South American ungulates of the order Litopterna. Their fossil range extends from the late Eocene until the late Pleistocene. The family shows a pronounced evolutionary trajectory throughout the Cenozoic, marked by an increase in body size and a reduction of the nasals, among other features. The basal members of the family, subfamily Cramaucheniinae, are known from many Oligocene and early Miocene deposits throughout the continent. Macraucheniines, are known from late Miocene and younger deposits. Unfortunately, the fossil record of this family is poor for the middle and late Miocene, a time in which many morphological changes that distinguish the two subfamilies began to evolve. Recently discovered macraucheniid remains from the late middle Miocene site of Quebrada Honda, Bolivia help bridge this gap by documenting two new species. One of these species (Species A) is represented by a partial hind limb and a nearly complete cranium preserving most of the upper dentition. It is distinguished from other macraucheniids by its lack of a postorbital bar and lack of a diastema between I3 and C. Species B is represented by a specimen that includes: a complete right dentary preserving the entire tooth row; partial fore- and hind-limbs; and parts of the axial skeleton. It differs from other macraucheniids in having a hypolophulid and paralophid of similar size on p4, a developed entoconid on m3, and it is smaller in overall body size based on m2 length. The two new species were added to the character-taxon matrix of a recent phylogenetic analysis of Macraucheniidae to test their evolutionary relationships. Species A plotted within Macraucheniinae, basal to Oxyodontherium but crownward of Scalabriniatherium. Species B plotted just basal to Theosodon. Quebrada Honda may be unique among South American fossil sites in preserving the co-occurrence of both a cramaucheniine and a macraucheniine.
Stability and interfacial behavior of graphene oxide by Langmuir-Blodgett studies

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It is considered that the most cost-effective method to produce the “miracle material” graphene is through the synthesis of graphene oxide (GO). GO is abundant in oxygen-rich functionalities that impart excellent solution processability and sites for further chemical modification. However, recently, a considerable number of reports demonstrated that it is unstable at certain conditions. The goal of this project is to investigate the stability of GO as a function of time, temperature and ultrasonication condition by studying the interfacial behavior of the nanomaterial by Langmuir-Blodgett (LB) experiments such area isotherm, hysteresis (reversibility) and monolayer stability kinetics. LB monolayers were transferred to suitable substrates for further analysis by Atomic Force Microscopy (AFM) and Scanning Electron Microscopy (SEM). Spectroscopic techniques such as UV-Vis absorbance, fluorescence and FT-IR analyses were also performed to correlate the molecular information to its interfacial behavior at the air-water interface.
Characterization of Familial Focal Segmental Glomerulosclerosis (FSGS)-linked alpha Actinin 4 (ACTN4) Mutant Proteins

Yuqian Tian

Several mutations of alpha-actinin 4 (ACTN4) have been found in patients with familial focal segmental glomerulosclerosis (FSGS), a kidney disease that is characterized by proteinuria and potential kidney failure because of glomeruli injury. ACTN4 is not only a critical component of cytoskeletal organization that binds and cross-links actin filaments, but also a co-activator for several transcription factors including estrogen receptor, p65, and myocyte enhancer factor-2. Based on its activities both in cytoplasm and in nucleus, researchers have attempted to understand the underlying mechanism of FSGS caused by the disease-causing ACTN4 (K225E) mutation. In addition to K225E mutation, this paper will study the characteristics of four novel ACTN4 mutants that are associated with glomerulopathies. Because ACTN4 primarily functions as an accessory protein in organizing actin filaments, we tested the actin binding affinity of each ACTN4 mutants to shed light on the potential effect of these mutants on cellular structure and dynamics. We found that K225E, P179L, and A830V mutants bind to F-actin more firmly than the wild type counterpart. In addition, we demonstrated that K225E and A830V mutants are degraded more readily in the ACTN4 overexpressed cells, while G29S and P179L mutants revealed to be more stable than the wild type. In view of ACTN4’s role in co-activating transcription factors and enhancing downstream transcriptional activities, mutants’ interactions with glucocorticoid receptor (GR) and p65 were examined using in vitro pulldown assays. Our data revealed that both K225E and A830V mutants have a weaker interaction with GR and so is A830V mutant with p65.
As many as 9.3% of Americans have Type 2 Diabetes Mellitus and the health care costs and lost wages of these patients accounted for 245$ billion in 2010 which equates to almost 15% of all health care costs in the United States. Although T2DM shows its symptoms nearly everywhere throughout the body, the most chronic complications that occur with diabetes are in the genitourinary system. These include diabetic bladder dysfunction, lower urinary tract complications, nephropathy, and sexual dysfunction. The clinical symptoms of diabetic bladder dysfunction are bladder over activity, urge incontinence, decreased bladder-filling sensation, poor emptying, and overflow incontinence suggesting a mixed depiction of storage and voiding problems of the urinary bladder. In order to understand the mechanisms of these symptoms, the current study looks at ERK1/2 and their role in the processes. These protein-serine/threonine kinases are in the Ras-Rad-MEK-ERK signal transduction cascade, which are very important in the pathways for cell growth and proliferation. It is thought that ERK1/2 play a role in the hypertrophic bladder stage seen in many T2DM patients before entering the decompensated bladder stage. In order to test this we have analyzed the storage and voiding characteristics of ERK1/2 knockout mice and compared them to genotypically normal mice. We have used Frequency Volume Chart to measure the 24-hour fluid consumption and micturition habits of the mice as well as superpubic catheter implantation and cystometrogram to analyze the voiding pressures and bladder capacity. Our findings suggest that the ERK1/2 knockout mice enter the decompensated bladder stage quicker than the normal mice. We are furthering our studies to determine the specificity of the bladder tissue layers where ERK1/2 exhibit their functions.
Morphogens are molecules that induce cellular responses in a threshold-dependent fashion during body plan patterning. The positional information model, also known as the “French flag model,” proposes that cells acquire distinct fates according to their positions in a morphogenetic gradient. Previous studies in the syncytial Drosophila blastoderm greatly advanced this model, since it assumes that cells are static during patterning and no cell proliferation or major gastrulation movements take place in the blastoderm. However, a recent observation revealed that nuclei do display stereotyped movements during this stage. The nuclei migrate from the lateral to the dorsal side of the embryo and these movements are disrupted in embryos with altered levels of the maternal gradient Dorsal/NF-kB. Here we investigate whether another gradient in the blastoderm, the Decapentaplegic (Dpp) gradient, plays a role in nuclear migration, since Dpp is regulated by Dorsal and the nuclei migrate towards regions with peak levels of Dpp activity. We show that Dpp mutant embryos had less nuclear density in dorsal regions compared to wild-type embryos, and thus less migration. Next, we asked how morphogen gradients can effectively regulate cell migration. To answer this question, we searched for downstream effector genes that respond to Dpp and are required in nuclear movements. We identified two candidate genes, GUK-holder (gukh) and frazzled (fra). gukh and fra mutant embryos were collected and imaged, and the nuclear density differences between the dorsal and ventral sides were compared to the wild-type. Similarly to Dpp mutants, we show that the lack of either GUK-holder or frazzled causes less nuclear density in dorsal regions, indicating decreased nuclear migration. Future research will determine whether these mutants display defects in cell fate specification, which would indicate an important role of cell migration for pattern formation.
EMG Controlled Wheelchair for Subjects with C4/C5 Spinal Cord Injury

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As of 1995 the incidence of spinal cord injury (SCI) was about 12,000 new cases per year. In 2012, it was estimated that roughly 270,000 (with a range of 236,000 to 327,000) people were living with a SCI. 47% of these SCI subjects were considered quadriplegic. These subjects with C4/C5 spinal cord injury cannot control their muscles below their shoulders. This means that they are unable to move without assistance. In order to increase independence for these subjects, we propose a motorized wheelchair that is controlled by Electromyography (EMG). Nine EMG pads will be used on the subject’s trapezius, platysma, and frontalis muscles and a reference electrode on the bony portion of the subject’s elbow to control an Invacare motor wheelchair. The EMG pads will acquire a signal from the subject’s still-innervated muscles, undergo signal modification with various filters and amplifiers, and then be interpreted by an Arduino UNO. These filters will include a bandpass, notch, and rectifier filter to isolate the necessary information embedded within the signal before amplification and interpretation. The outputs from the Arduino UNO will connect to the joystick of the Invacare wheelchair and use the preprogrammed algorithms to make the wheelchair move as though it were controlled by the original joystick.

Project Mentor: Dr. Matthew Williams and Dr. Colin Drummond, Department of Biomedical Engineering
The purpose of this work was to quantify how the two phases, glass and crystalline, in a bulk metallic glass matrix composite (BMGMC) deform cooperatively during tensile loading. With increasing temperature, BMGMC’s can experience dramatically increased bulk strain prior to catastrophic failure. It was hypothesized that the temperature dependence of plasticity in BMGMC’s is due to the temperature dependence of the cooperative plastic deformation in the glass and body-centered cubic crystals (dendrites). At room temperature, the crystalline phase is softer and more ductile, but at elevated temperatures near the glass transition temperature the glass phase is softer and more ductile. The hypothesis was tested by quantifying the correlation between macroscale plasticity and the microscale plasticity experienced by individual dendrites by measuring the changes in aspect ratio of the nominally spherical dendrites. The results confirmed the lack of a 1:1 correlation between bulk and dendrite strain. This is indicative of a transition in properties, where at room temperature the crystalline phase experience more ductility then the glass phase, and at elevated temperature the crystalline phase experienced less ductility than the amorphous matrix.
Abstract
Cigarette smoking has proven to be a detriment to society due to its adverse effects to human health. It has been linked to a myriad of diseases, specifically cancers, respiratory diseases and heart disease. These health impacts are often tolling to nations across the globe. Among the nations most affected is the Socialist Republic of Vietnam, where the World Health Organization predicts that 10% of the Vietnamese population will die from related smoking diseases by 2020. In addition to the damaging effects on health, smoking also negatively impacts the Vietnamese economy. A source of the high prominence of smoking in Vietnam is due to the foundations deep rooted in Vietnamese culture, which has been prevalent for centuries. In this research paper, we will study the anthropology of cigarette smoking in Vietnam from a public policy perspective.
In the 2010 US census, 6.7 million adults reported limited hand and finger dexterity, with millions more suffering from the likes of arthritis and carpal tunnel syndrome. One of the many consequences stemming from these issues is the incapability of utilizing modern touchscreen electronic devices (smartphones, tablets, laptops, etc.). These individuals simply lack the motor control necessary to effectively and efficiently use these devices. To solve this issue, we have created a process that allows electronic devices to be controlled via EMG and accelerometer signals. A user wears a set number of electrodes and accelerometers, all of which together model the movement of their upper arm in space and time. Characteristic arm movement (via accelerometer data) and muscle activity (via EMG data) is passed through a classifier which will be used to dictate movement of a cursor on the user’s electronic device. Not only does this framework allow for easy and intuitive transduction of arm movement to cursor control, it also allows for personalization. As most people do not exhibit similar muscle characteristics (e.g. distance runner vs. body-builder), there will be a calibration phase which allows for extremely accurate model creation on a per person basis.
Abstract

Playfulness is an important trait in the development of children’s social skill sets. Pretend play also plays a vital role in the formation of these skills. Children with autism spectrum disorder (ASD) and children with Prader-Willi syndrome (PWS) demonstrate impairments in their social interactions and communication skills as well as in their pretend play skills. One purpose of this study was to investigate how playfulness ratings in children with ASD compare to playfulness ratings in children with PWS. Another focus of this study was to investigate whether joint play with a partner would increase playfulness ratings. A third aim of this study was to investigate whether there is a correlation between playfulness and pretend play ratings in children with PWS.

The Multidimensional Playfulness Scale (MPS), which incorporates some elements from the Child Behaviors Inventory of Playfulness (Rogers et al., 1998) and the Playfulness Scale (Form K) (Lieberman, 1977, p. 153-157), was developed to measure playfulness ratings for the study. Videos of the “Make-Believe Play” portion of the Autism Diagnostic Observation Schedule (ADOS), 10 videos of children with ASD and 30 videos of children with PWS, were scored using the MPS. To determine if joint play with a partner increased playfulness ratings, the MPS was used for independent play and joint play periods during the ADOS. In order to investigate whether or not playfulness and pretend play ratings are correlated in children with PWS, the Affect in Play Scale (APS; Russ, 2014) was used to measure pretend play and was compared with playfulness ratings using videos of the ADOS.

It was hypothesized that children with ASD would exhibit higher playfulness ratings than children with PWS ratings. Joint play with a partner was expected to increase playfulness ratings. Finally, it was hypothesized that playfulness and pretend play ratings using the MPS and APS, respectively, would be negatively correlated.
The C-reactive protein (CRP) is a multi-faceted molecule that has played an increasing role in clinical aspects of human medicine as it has been associated with numerous inflammatory diseases, especially atherosclerosis and Crohn’s disease. By comparing not only two important inflammatory diseases, but analyzing the risk and demographic factors of each disease, we can begin to gauge the independent reliability of the C-reactive protein as a reliable biomarker in humans.
Many fundamental properties of our universe are known to us. For centuries, we have had a description of the force of gravity, but no idea as to its ultimate source—the reason why it behaves as it does. Einstein’s theory of General Relativity attempts to solve this mystery, and does so with a high degree of success. Utilizing the Einstein field equations to relate the curvature of spacetime to the presence of matter, we may gain some understanding of the phenomenon of gravitation. Einstein’s equations, however, are not necessarily applicable to the big picture. We cannot use what is known about spacetime locally to determine the global properties of the universe. Thus, we cannot use these theories to determine the shape of the universe.

Here, we outline a method to search for signatures of a cosmic topology by expanding on previous searches. We focus on the simplest topology (the three-torus) that admits a flat local metric, and by examining the eigenspectrum that results from a given set of parameters, we outline a way to determine the likelihood of a successful model given an observed data map (in our case from the Planck Satellite). Finally, these methods are implemented in a computer code of our design to numerically analyze the eigenspectrum and resulting likelihood. The likelihood itself will allow us to conclude our search. Given that we obtain a significant value, we will know to a high probability that our universe has three-toroidal topology.
Characterizing the Association Between Mandible Strength & Function

Load-bearing craniofacial bone substitutes must possess some minimal strength that allows the patient use of their jaw while it heals. We propose an in-vivo animal model that allows for assessment of this minimum strength without requiring implantation of any strain gauge hardware. We do this by demonstrating that dental morphology in rabbits provides a physiologic & quantitative measure of mastication that can be predictably altered with a specific unilateral mandible defect. A pilot study of 5 rabbits given unilateral hemi-mandible bone and/or neural defects was made to explore the effects of various mandibular insults on mastication. Defects ranging in size from 8 mm (critical size defect) to 25 mm 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 de-innervation 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 structural integrity of the hemi-mandible. Furthermore, structural integrity was reversibly compromised with specific defects of the hemi-mandible and quantified ex-vivo. These results suggest that dental changes from a defect can provide a quantitative measure of hemi-mandibular strength. Larger studies are justified to validate this animal model as a means for testing load-bearing bone substitutes.
Hemophilia B (also known as Factor IX deficiency) is an X-linked recessive disorder that affects 1 in 30,000 males. The majority of the factor IX cases (2/3) are the result of a de novo mutation, many of which results in a severe form of the disease. The remaining families are affected with mild to moderate forms, which is more likely to be handed down familially. Before the discovery of factor IX replacement therapies in the 1980s, people with the severe form of the disease had a high level of early mortality and early disability, which resulted in a low fertility. In contrast, there is little data on fertility patterns of those who are affected by, or are carriers of, a factor IX mutation. This study looks at an Ohio Old Order Amish population that has a significant number of individuals with the T296M mutation as a result of founder effect, that is a gene being passed down from a common ancestor. The research compares family size, sex ratio and birth spacing in three types of families, those with carrier mothers, affected fathers and a control group. The purpose of this research is to learn the impact of the hemophilia B mutation on fertility. The results of this study allow researchers and health care providers to better understand the transmission of the factor IX gene mutation. This topic is especially important as improved treatments have allowed severe factor IX deficient patients to have better health outcomes, normal lifespans and a higher fertility rate than previously.
Children’s ability to regulate and understand emotions is a protective factor in relation to the development of depression and other psychological disorders. Thus, it is important to improve our understanding of emotion regulation and perception in order to inform intervention and prevention efforts. This research aims to identify specific neural, emotion-perception processes that are related to elevated risk for depression and other related issues. The daughters of mothers who have depression were asked to respond to emotional stimuli tasks; neural responses were measured via electroencephalogram. Several report indexes were used to measure youth emotional and behavioral problems, family functioning, and exposure to stressful events. A perceptual sensitivity score was used to measure the amount of information a child needs to perceive an emotion. Results indicated that more socially anxious adolescent girls less accurately recognized happy faces in relation to normal scores and as a result have a lower perceptual sensitivity score. Thus, there is a negative correlation between perceptual sensitivity and the child’s anxiety; adolescent girls with social anxiety in this sample showed significant difficulty in recognizing happy faces. Addressing adolescent girls’ low perceptual sensitivity and any difficulties in recognizing emotions could help target intervention methods and improve preventative methods for depression and psychosocial issues for this population.
**Title**  
Expressing Constructs of Soluble Guanylyl Cyclase for Structural Insight on the Effect of the Coiled-coil Region on the Catalytic Domain

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**Elevator Speech**  
Soluble guanylyl cyclase is the target of the common drug nitroglycerin for heart failure, yet alternative drugs targeting sGC for conditions involving irregular blood pressure could be therapeutically interesting. New expression constructs and structures targeted in this project could aid drug development.

**Key Words**  
soluble guanylyl cyclase  
expression  
crystallography  
structural biology

**Abstract**  
Soluble guanylyl cyclase (sGC) is a physiologically important enzyme known for its regulation of vasodilation and is the only known receptor for nitric oxide. Its function makes it an ideal drug target for conditions involving abnormal blood pressure, so solving its structure could lead to the development of compounds to treat a variety of diseases. The structure of the full sGC heterodimer is not known, although structures of most of its four domains alone have been successfully crystallized (or homologs thereof). The goal of this project is to design a method to express the catalytic domain along with a series of truncations of the coiled-coil region to characterize the effect of the coiled-coil region on the activity of the catalytic domain. The first experimental design used the expression vector pET-DUET-1 to express both subunits from the same plasmid while only adding a fusion thioredoxin-His-tag to the alpha subunit to promote correct heterodimerization as beta-beta homodimerization of the catalytic domain is significant. Two different approaches to purification were used: Ni-NTA agarose purification and GTP-agarose purification. Ni-NTA agarose purification yielded a large amount of the alpha subunit and appeared to contain some of the beta subunit on SDS-PAGE, but cGMP ELISA activity measurements resulted in insignificant basal activity uncharacteristic of purified heterodimer. GTP-agarose purification, which is known to encourage heterodimerization through binding to the catalytic domain, failed to yield a significant amount of heterodimer on SDS-PAGE and also resulted in insignificant basal activity. An experimental redesign involving both subunits His-tagged in separate vectors and purified in combination with its complementary subunit has been seen to be successful in experiments with the catalytic domain alone and is currently being employed for the separate truncated constructs of the coiled-coil region with the catalytic domain.
Living cells respond to chemical cues in their external environment by a complex signaling system: activated receptors on the cell surface initiate a cascade of reactions involving enzymes, catalyzing the addition and removal of phosphate groups in a sequence of proteins. The cell's survival depends on its ability to accurately amplify the signals through this cascade, and modify behavior based on the received signal. The inevitable byproduct of amplification is noise, emanating from the stochastic nature of the biochemical reaction network. Using a combination of theoretical and computational approaches, we have discovered that the cellular error's dependence on time delay behaves as a sigmoid function, similar to the behavior of a sensor starved of fuel.
Poly[3]rotaxanes are a type of interlocked polymer that are expected to have unique mechanical properties. At an atomic scale, these polymers are similar to sets of interlocked rings similar to the Olympic Rings or a chain link. Due to this unique structure, this class of polymers can have highly tailored mechanical properties that could mimic biological materials.

Abstract

Rotaxanes are a type of mechanically interlocked molecule, consisting of a molecular “dumbbell” threaded through a macrocycle, which can be used as a repeat unit to form larger interlocked polymers (i.e. polyrotaxanes). Since interlocked polymers are primarily composed of mechanical bonds, instead of covalent bonds, the material properties are dominated by component geometry as opposed to chemical structure. Due to the complexity of mechanically interlocked molecules, it is difficult to optimize component geometry by purely synthetic techniques, thereby necessitating the use of an integrated experimental and computational approach. Herein we report the synthesis of a novel double-threaded poly[3]rotaxane by a metal-templating process with the 2,6-bis(N-alkyl-benzimidazolyl)pyridine ligand. Design of the poly[3]rotaxane was supplemented by atomistic simulations used to determine the optimum component geometry to prevent disassembly of the interlocked structure. Further coarse-grained dissipative particle dynamics (DPD) simulations were used to calculate rheological properties of the bulk material in order to understand the relationship between component geometry and material properties. By understanding the structure-property relationships of mechanically interlocked polymers, future materials can be designed more efficiently and with a greater degree of structural control.
Abstract

Even to this day, the parasitic disease malaria is one of the world’s most rampant diseases. Although there have been many advances to prevent future outbreaks and minimize the current associated morbidity, incomplete control efforts have resulted in an increase in resistant to antimalarial drugs. One of the underlying reasons for the inefficiency of the drugs is due to the nature of the most common strain of malaria, Plasmodium falciparum. In this study we hope to identify the specific mutations in plasmodium falciparum that cause this resistance using PCR, LDR and Bioplex techniques in the wet laboratories. In addition to the mentioned laboratory work, understanding the local historic and cultural patterns associated with malaria infections in Kenya is just as important. Over the years, the number of in malaria infections have varied greatly, and understanding the nature of the disease will help us improve preventive and treatment methods. Descriptive and statistical analysis was utilized to see patterns in infection in the same and different cohorts longitudinally. Understanding the local population in relation to this endemic disease will help maximize problems with current and future control efforts, and ultimately help create a control effort that will reduce the number of cases and associated morbidity with malaria in Kenya.
The family Proterotheriidae is a mammalian group belonging to the extinct order of South American endemic ungulates known as litopterns. In this contribution, a new proterotheriids specimen from the middle Miocene Quebrada Honda fauna, from southern Bolivia, is described. This fauna pertains to the Laventan SALMA (South American Land Mammal Age), and proterotheriids from this time and region of South America have not previously been studied in detail. This specimen consists of a left dentary with all lower molars (m1-m3) and a partial premolar (p4); a right dentary with partial m1-m2 and complete m3; and a left maxilla including P4-M3. The distinguishing morphological characteristics of this specimen include a well-developed entoconid that is independent from the hypoconid on the m3, an M3 that lacks a hypocone, an independent menaconule placed near the metacone on the M2, and a parastyle that is more developed than the mesostyle in the ectoloph of the M2. These features distinguish it from all other genera (and species) of proterotheriids of Laventan age, including Diadiaphorus, Prolicaptrium, and Neobrachytherium. Thus, it is likely that the specimen represents a new species of Proterotheriidae unique to the middle Miocene of Bolivia.
In order to understand long term degradation of polyolefin we ran long term accelerated degradation tests. Three market available PV wires were exposed to a variety of ASTM-recognized accelerated stress tests for over 4000 hours. The Frontier transformed IR spectra (FT-IR) were analyzed for the insulation of three commonly used PV wire types, this technique reviled the insulation’s chemical signatures and mechanisms of degradation. While it is well known that UV degrades polyolefin it is noteworthy that the major trigger of polyolefin oxidation is a result of UV exposure and the formation of small free radicals though the Norrish I and II reactions. Large variations in the FT-IR were observed, this suggests the composition of the insulation varied over the length of the wire. These variation result in different rates of degradation in different locations along the surface of the wire. It was concluded that the 720 hour standard cyclic exposure time is not enough to fully encompass the degradation of a wire over its lifetime. Given the performance metric this suggest that the UL standard 4703 is not stringent enough to guarantee the life of the wire in photovoltaic set up.
Fibrosis is currently an untreatable condition characterized by excessive production of extracellular matrix proteins by fibroblasts, leading to an eventual loss of tissue function. While it has been shown that activated B-catenin is sufficient to cause skin fibrosis in mice, the genetic mediators and modulators by which the disease progresses are still unknown. Through whole-transcriptome sequencing of mouse fibrotic dermis, we have identified a number of both coding and long non-coding (lncRNA) RNAs that are upregulated in mice with stabilized B-catenin activity. By comparing the most highly differentially expressed coding genes in our mouse model with data from publicly available gene expression databases, we have identified a number of B-catenin regulated genes that are also found in human fibrotic conditions. One example of such a gene is biglycan, a regulator of collagen fibril diameter that is overexpressed in human tumor stroma and systemic sclerosis, as well as in our fibrotic mouse model. We are now working to describe the functional role of the most promising lncRNA candidates through loss- and gain-of-function experiments in vitro. The identification of B-catenin regulated RNAs and lncRNAs involved in the formation of fibrosis will be informative towards identifying new therapeutic targets for treatment of the condition.
Despite overall decreasing numbers, colorectal cancer is still the second leading cancer killer in the United States. It is important to develop a thorough understanding of racial and ethnic variation in colorectal cancer incidence and mortality. Colorectal cancer (CRC) carcinogenesis rates have been found to differ between racial and ethnic groups. African Americans have the highest incidence and mortality rates, followed by American Indians/Alaska Natives, Caucasians, Hispanics, then Asians/Pacific Islanders. The published literature suggests several possible explanations for this discrepancy. It has been proven that high saturated fats increase risk of colorectal cancer, but some studies have shown unidentified genetic and/or environmental protective factors that are capable of countering this risk. Other studies propose an association between an insulin-like growth factor pathway and risk of colorectal cancer risk. They posit insulin resistance to be an important player in the link between energy imbalance and colon carcinogenesis, due to significant racial differences in anthropometric and genetic influences on the insulin-like growth factors. There is also research that links the increased risk to socioeconomic factors other than race, such as education level, status of health insurance, and medical screening. However, this is posited to be just a few of many elements in the multifactorial onset of colon cancer. This literature review aims to investigate the differences in colorectal cancer carcinogenesis in between African Americans and Caucasians from a genetic perspective. Current literature fails to completely explain the increased incidence and mortality rates in African Americans, and a genetic perspective could elucidate the discrepancy.
The Role of Missing Information in Humor Elicitation

John Cabot, Department of Cognitive Science

This project explores an “incompleteness effect” that seems to be implicated in certain kinds of humor, such as inside jokes and one-word comments that rely on a mutual understanding of background knowledge. Many, perhaps most, punchlines to jokes require the audience to do some kind of inferential work to grasp the point; if that work is reduced too far, the humor evaporates. Famously, explaining a joke kills it. This paper reviews a number of existing theories of humor that have attempted to specify conditions in which humor is experienced in both social and non-social situations, and considers how well each serves to clarify the contribution of incompleteness to certain types of humor. It also explores the degree to which this element constitutes a defining feature of a natural type of humor, distinguishing it from, for example, slapstick, and considering its importance for a meaningful classification of types and sources of humor. Finally, it proposes avenues for empirical investigation of the function of missing information in the elicitation of humor, through studies looking at correlations between perceived humor and processing time.

Project Mentor: Professor Vera Tobin, Department of Cognitive Science
Securing and maintaining vascular access through the placement of catheters is a mainstay of patient care. It is estimated that over 150 million lines are placed each year in the United States, and catheter-related bloodstream infections afflict approximately 250,000 patients annually. While the incidence rate (0.17%) may appear low, CRBIs dramatically increase health care expenditures with extended hospital stays and higher patient care costs.

The current accepted method for port cleaning is to wipe the surface with an alcohol swab and waiting to allow the isopropyl alcohol solution to evaporate prior to needle insertion. When applied, this method is effective but time consuming and it must be done repeatedly in time-sensitive environments such as operating rooms. Compliance with alcohol swabbing protocols is poor and typically reported to be about 40% across patient caregivers due to:

1. lack of universal protocols
2. excessive workloads
3. no alcohol wipes at bedside

Non-compliance is exacerbated by low adherence to hand washing requirements and the presence of bio-contaminates on caregivers hair and environment.

The envisioned solution is a sterile strip dispenser that clips over the injection port. The strips are impregnated with an appropriate sterilant(s), e.g. 70% alcohol. A tab is pulled across the port and the injection is made through the fresh sterilant strip. This decidedly “low-tech” approach provides sterilization that can address the basis for alcohol swab noncompliance through an easy to follow protocol, reduced workload, and ready access. Used strips also provide a ready mechanism for use verification and compliance auditing.
Breast cancer affects approximately 1 in 8 American women. Many breast cancer patients receive taxane-based chemotherapy and/or aromatase inhibitors (AIs) as treatment. A possible toxicity (side effect) of AIs is joint and muscle pain, taxanes can result in peripheral neuropathy, or numbness and pain in extremities. To investigate if there were differences in the tumors associated with toxicity, measurements were taken of RNA expression of all known genes in tumors of 61 breast cancer patients. The laboratory looked for which genes had different expression in those with and without toxicity using a t-test, and then looked at which pathways of genes were different using gene ontology enrichment analysis. Among 6 patients who experienced AI toxicity and 39 patients who took AIs without toxicity, as all was self reported, it was found that several pathways were altered including enzyme activity (p=1.6 X 10^-9). No individual genes known to be involved in pain sensation were statistically significant associated with toxicity. Among 7 patients who experienced neuropathy from taxanes and 21 who did not, the laboratory found different expression of pathways involved in pain sensation (p=7.8 x 10^-13). Therefore, it is likely that genetic variation causes both differences in expression in the tumor and different responses to the treatment in the rest of the body, resulting in these side effects. Additional experiments are currently being carried out to validate these findings. Findings from this study could help develop a test to predict toxicity using tumor samples that are already being removed and help patients and physicians customize treatments to provide the most effective treatment with least toxicity.
Battling Optical Losses in Plasmonic Metamaterials

Metamaterials are materials with properties that do not exist in nature. Thus, they can be used for novel, never-before-seen applications like cloaking, imaging beyond the diffraction limit, and single-molecule detection. However, they are very lossy, and in order for these uses to become a reality, these losses must be overcome.

Current efforts to produce highly performing plasmonic metamaterials in the visible range have been hampered by the inherent strong optical losses of metals. In this project we demonstrate the possibility of significantly reducing these losses through a comprehensive investigation of plasmon-exciton dynamics through time-resolved and ultrafast transient spectroscopic methods. We first confirm strong coupling between gain (quantum dot) and metallic (gold nanoparticle) elements dispersed in a stable, freestanding polymer matrix by observation of fluorescence quenching and reduction in fluorescence lifetimes. Then, through transient absorption spectroscopy we show a clear temporal dependence of the loss mitigation, with maximum mitigation occurring instantaneously upon excitation of the gain and decreasing over time. A small but noticeable enhancement in the transmission remains after long times, upwards of 10 nanoseconds, and overall the evolution of the mitigation over time can lead to optimizing of the pumping process. Moreover, we also see a power threshold for the enhancement which suggests an optimal power for excitation as well. Such insight into the excitation process and the dynamics of the system is critical in optimizing the exciton-plasmon resonant energy transfer (EPRET) that leads to attenuation of losses in the material.
What makes a child’s speech sound different from that of an adult? To examine one of the potential explanations of this difference, the current study replicated a portion of Lisa Goffman’s 2004 publication “Kinematic differentiation of prosodic categories in normal and disordered language development.” Data on the movements of the head, mandible, and lips was collected for 7 children with typical development (ages 3-7 years; 1 male, 6 females) and 7 college students with typical development (1 male, 6 females). The researchers gathered normative data on the speech kinematics used to produce four disyllabic nonsense words with contrastive lexical stress (e.g., “PApa,” “paPA,” “BAba,” “baBA”). Lexical stress, for this project, is defined as the relative emphasis given to either syllable within a disyllabic word – trochaic, or strong-weak stress (e.g., “PApa” and “BAba”), and iambic, or weak-strong stress (e.g., “paPA” and “baBA”). The two primary research questions were as follows: In children with typical development, is there a difference in the spatiotemporal index (STI), a measure of articulatory stability, between trochaic and iambic productions? When comparing children to adults, is there a difference between STI values in lexically contrastive productions? It was hypothesized that, when compared to all adult speech productions, child speech productions would have higher STI variability overall and especially with iambic stress patterns. Using a motion capture system of infrared cameras combined with simultaneous audio and video recordings, twelve productions of each of the four stimuli words were collected from each participant. Lip aperture, or the open-close movements of the lips, was isolated and plotted to visualize variability and calculate STI values. To date, the plot comparisons and STI values have shown minimal variability between and within groups, suggesting the need for further exploration with an increased sample size.
Hepatocellular carcinoma (HCC) is the third most lethal cancer in the world. One reason is that master regulators of cell cycle exit by apoptosis (e.g., TP53, p16/CDKN2A) are often mutated/deleted in HCC. Thus, most systemic treatments, which are typically designed to induce cell cycle exit by apoptosis, select for apoptosis-resistant HCC. Additionally, 90% of primary HCC is poorly differentiated, yet the underlying mechanisms of how differentiation is impeded are not known, preventing development of differentiation based therapies. We hypothesized that alteration of lineage specifying transcription factors and their cofactors favor recruitment of corepressors instead of coactivators.

Active corepressors in HCC that can be inhibited with known small molecules were used for in-vitro assessment of inducing differentiation of HCC.

Using gene expression microarray studies we identified that hepatocyte lineage specifying transcription factor GATA4 was decreased in normal tissue relative to adjacent HCC (n=46 pairs, p<0.0001). Interestingly, other liver lineage factors such as FOXA1/A2 were unchanged. Of genes with average expression 1.5 fold higher in normal liver vs adjacent HCC, 362/736 were gene ontology annotated as liver differentiation genes (p<1.2x10^-124) suggesting that master transcription drivers (e.g, FOXA1/2) of these genes favor recruitment of corepressor proteins instead of coactivators. Thus, if the active corepressors are known, they can serve as a logical molecular target for inhibition to promote differentiation of lineage committed HCC cells. The active compressors for which we have small molecule inhibitors against included DNMT1, SMYD2, BAZ2B/A, EZH2 and WDR5.

In-vitro treatment of HCC cells with inhibitors of DNMT1 and SMYD2 promoted cell cycle exits by differentiation and reduced cell proliferation in a p-53 independent manner.

We show here that targeting corepressors in HCC can induce cell cycle exits by differentiation.
Abstract

Spinal cord injury (SCI) affects nearly 300,000 people in the U.S. with an estimated 12,500 new cases each year. The severity and extent of paralysis depends on the location of injury with 14% of cases resulting in complete tetraplegia. Recent advances in neuroprostheses have begun to restore independence to such patients by providing them with controllable limbs to interact with their surroundings. To use these devices, patients need a way to define a location in space and transmit that information to the neuroprosthesis. Once a point on an object is defined, the neuroprosthesis can then interact with the object via a variety of actions; such as, picking up the object, pressing a button, etc. Our team is developing a head-mounted device that will allow SCI patients to define desired locations in space solely through the movement of their head, neck, and shoulders. Prototype experimentation with an Arduino is underway to determine how best to collect the distance from the user to the object and the orientation of the user’s head. By combining a rangefinder, inclinometer, and magnetometer, we define a spherical coordinate system in which the user can establish vector locations of the neuroprosthesis and the desired object. These two vectors can then be subtracted to acquire a position vector from the neuroprosthesis to the object. Eventually, necessary electronic components will be condensed to a specialized printed circuit board and mounted to an elastic headband to fit a wide range of users.
Excitons form when electrons in the valence band of a semiconductor are excited into the conduction band and bind to the positively charged hole that they leave behind in the valence band. In ionic materials the binding is strongly modified by the coupling between vibrational modes of the crystal called optical phonons, and the electron and hole. Richard Feynman studied the effect of optical phonons on the motion of a single electron moving through an ionic crystal using a variational principle based on his path integral picture of quantum mechanics. We have generalized Feynman’s analysis to determine the exciton binding energies in ionic crystals. The results are applicable to halide perovskites, materials with potential applications to photovoltaics, that are studied by complementary computational methods by the group of Professor Lambrecht at CWRU.
All PV modules require active elements to load and convert the maximum power output of the cells. Most typically this device is a large inverter optimized for many commercial modules. Recently, smaller inverters connected to each module, called microinverters, have shown greater energy harvest and ease of use. The holy grail of the industry is a high granularity converter on a multiple cell configuration embedded into the module, operating in extreme high efficiency. Wide band gap materials enable that type of non-invasive converter due to their extreme high frequency operation. These devices are smart, with embedded microcontrollers, and can be used for far more than just controlling a converter. We will design a smart converter for use specifically in the PV segment, to tie into the physics of failure of these devices by embedding high fidelity and high bandwidth sensors for prognostics and active health management of photovoltaic cells and converters. We will embed this system into PV “minimodules” and combine with ambient condition sensors for a holistic health management PV system.
Crohn's Disease (CD) is a progressive intestinal condition of humans that has no cure. Finding a cure has been difficult because studying disease before people get sick is impossible. By using mathematics and biological data from a family of Crohn's Disease-like-susceptible mice we illustrate a dynamic strategy to develop a cure.

Our objective was to quantify and mathematically model hypothetical mechanisms of lesion progression (initiation and dispersion) in SAMP mice, a well-established mouse model of CD that is uniquely characterized by cobblestone lesions at 30 weeks of age. By obtaining three-dimensional stereomicroscopic measurements (area, location, angle, over time and space) from the gut lesions in various SAMP mice at 3.5, 7, 14 and 30 weeks of age, we simulated the discrete evolution of cobblestone formation using a lattice-based interacting particle model. Of dynamic relevance, we discovered that cobblestone lesions in mice develop and disperse in a way that resembles the complex dynamics of fire proliferation in naturally-occurring forest fires, in which at least three areas of disease activity are expected to occur (burned, burning front, and not affected areas). This mechanism of CD expansion in SAMP mice contrasts the principle and severity of disease in another CD mouse model used in research medicine (B6TNFARE). Disease progression in B6TNFARE mice is more predictable resembling the motion of a growing wave of 'villous-aggregation' islands (not cobblestones) that starts at the cecum-ileum junction and ascends towards the oral cavity.

Our findings can be used to determine optimal areas for tissue sampling in immunological studies, and to philosophically envision CD as a disease that has a burning fire front that can be targeted to prevent disease progression.
**Abstract**

The Rayleigh-Taylor instability occurs when a less dense fluid is accelerated through a denser fluid. For example, if water is placed atop an oil layer in the absence of gravity and then gravity is “turned on” suddenly, the water will fall to the bottom of the container, with the interface between the fluids first forming a sinusoidal pattern that grows exponentially with time. In later time, the growth slows as the interface forms the characteristic mushroom-shaped bubbles of the rising less dense fluid and spikes of the falling denser fluid. While some theoretical work has been done for a layered system (e.g., oil-water-oil), in which interfacial communication can affect the growth of the unstable interface, little has been done experimentally. Using the technique of magnetic levitation, we measured the dispersion relationship of the early growth in a layered system of a finite layer of denser fluid between two semi-infinite layers of a less dense fluid by maintaining a constant layer height and varying the initial perturbation wavelength.
An increasing number of recent studies have implicated an oral commensal, invasive, facultatively anaerobic gram negative bacterium, Fusobacterium nucleatum, in the pathogenesis of colorectal cancer (CRC). While these are rare constituents of the fecal microbiota, F. nucleatum have been previously linked to periodontitis, have been cultured from biopsies of inflamed gut mucosa and most recently have been reported to be enriched in colorectal cancer. A highly invasive strain, referred to as Fn EAVG_002, was found to increase tumor multiplicity and selectively recruit tumor-infiltrating myeloid cells to promote tumor progression in Apc min/+ mice; an in vivo model to study colorectal cancer. We previously reported a novel phenotype in head and neck squamous cell carcinoma, where overexpression of an epithelial cell derived antimicrobial and immunoregulatory peptide, referred to as human beta defensin-3 (hBD-3), was responsible for selective recruitment of myeloid cells to the lesion site. Moreover, we identified that hBD-3 act as a chemokine to attract myeloid cells via the surface receptor CCR2.
15-Hydroxyprostaglandin dehydrogenase (15-PGDH) is thought to be a new target in colon tumor suppression due to its antagonistic effects on the COX-2-catalyzed prostaglandin-mediated inflammatory pathway by degrading PGE2, a synthesized prostaglandin that is up-regulated in colorectal cancers. In normal, healthy colonic tissue 15-PGDH is highly expressed, but has significantly decreased detectability in colorectal cancer. Literature has shown the variance of expression levels of 15-PGDH in both healthy and neoplastic tissue, but has not yet been studied in colonic tissue diseased with polyps. Patients with colorectal polyps are at an increased risk for colorectal cancer. The purpose of this study was to examine the correlation of 15-PGDH expression levels with colorectal polyps. Colorectal tissue biopsied from 129 patients with and without a history of polyps was had their expression for 15-PGDH assessed using qPCR. Gene expression was determines utilizing different SNPs located on the 15-PGDH locus. The study specifically selected for genetic and environmental factors including race, gender, smoking habits, diet (etc.) to determine which factors affected 15-PGDH expression in patients with and without polyps using the 15-PGDH expression levels from the qPCR data.

As the incidence of colorectal cancer increases and screening becomes more relevant, 15-PGDH expression levels can be evaluated for risk of colorectal neoplasia as well as a new target for chemoprevention.
Ego depletion researchers have studied the deleterious effect of self-control on a person’s subsequent ability to self-regulate his or her own actions or thoughts. Sometimes when people try to self-control their actions and thoughts, we fail. For example, after studying many hours for an exam (as opposed to not studying), people may find it easier to eat a chocolate-chip cookie. Why might someone eat the cookie? Research has not distinguished whether a person’s failed self-regulation mechanism is due to a deficiency in self-regulation abilities or the natural desire to satisfy one’s needs. The current experimental goal was to determine the influence of self-regulation on one’s desire to avoid work (relative to neutral stimuli). The Work Approach-Avoid Task (W-AAT) was used to measure participants’ approach motivation towards work and neutral related stimuli after performing a hard or easy puzzle task requiring self-control to complete. The W-AAT is a joystick paradigm that measures approach bias via a faster “pull” versus “push” responses, whereas the reverse indicates withdrawal bias. Eighty-five undergraduates participated in the experiment, of which 42 completed the hard task and 43 completed the easy task. In addition, participants completed a demographic and ethnicity worksheet, Behavioral Inhibition and Behavioral Activation Scales (BIS/BAS), and answered a questionnaire about the W-AAT. The W-AAT was done once, after the participant completed his or her respective task type (easy or difficult condition). Contrary to what was expected, individuals who performed the difficult task did not have a significantly faster withdrawal bias to pictures of work versus pictures of neutral images. The results suggest that people may be able to override the effects of self-control when giving a subsequent task.
After radical prostatectomy, around 30% of prostate cancer (PCa) patients experience biochemical recurrence (BCR), for which the best predictor has been the qualitative Gleason score (GS). Computerized image analysis methods have allowed for enumeration of quantitative histomorphometric (QH) measurements from H&E images and been predictive of BCR. Additionally the Feulgen (FG) stain reflects nuclear DNA content, a feature linked to PCa presence and aggressiveness. We show that BCR can be accurately predicted by combining QH measurements of morphology and architecture from H&E and FG tissue images. This study comprised of 69 patients (20 BCR and 49 non-recurrence (NR)). For each patient, a total of 242 QH features describing nuclear shape, architecture, and disorder were calculated from the H&E and FG stained TMA core images. The top 10 ranked features for each stain type were selected using minimum redundancy maximum relevance feature selection scheme then used to train a random forest classifier to predict BCR. We compared the predictive value of classifiers built using 1) GS, top features of 2) FG, 3) H&E, 4) FG + H&E, and 5) FG + H&E + GS. Classifier BCR predictions were evaluated by Kaplan-Meier analysis. The top FG and H&E features described nuclear shape and architecture (Fig.1 A-D). The BCR and NR groups predicted by the GS classifier did not show statistically significant (p<0.05) differences in BCR-free survival via a log-rank test while predictions using QH features extracted from FG and H&E images revealed statistically different outcomes (Fig.1, E-I). Furthermore, combining GS, H&E and FG together showed the highest classification accuracy, 0.75 and the lowest p-value, 3e-7. The combination of morphology and DNA related features predicted BCR more accurately than predictions made from only GS or only one set of quantitative features.
A model has been proposed that allows one to estimate the perceived dissonance of musical intervals from their tuning and Fourier spectra of their constituent tones [9W. Sethares (1993) J. Acoustic. Soc. Am. 94(3), 1218-1228]. The work reported here tests this approach by comparing its predictions to data obtained in an experiment in which musicians reported their dissonance perceptions for a variety of organ intervals. Theory and experiment are in fair agreement.

What makes a chord dissonant? We have completed the first rigorous perceptual test of the leading model, due to Sethares, that offers quantitative dissonance predictions for arbitrary chords.
Hyperbolic Metamaterials: Surface Plasmons, Bulk Plasmon Polaritons and Applications in Biological Sensing

Hyperbolic Metamaterials can be used to detect biological molecules, including viruses and cancer markers such as prostate-specific antigen, with extremely high precision.

Metamaterials are artificial, subwavelength-structured media with unusual optical properties. In particular, Hyperbolic metamaterials (HMM) are a highly anisotropic class of metamaterials characterized by hyperbolic dispersion. A material with this type of dispersion relation can be fabricated by depositing alternating layers of noble metals and dielectric materials with typical thicknesses much smaller than the operative wavelength. Metals and dielectrics differ in the signs of their permittivity, and along the interface of materials with different signs of permittivity, specific electromagnetic waves called surface plasmon polaritons (SPPs) are generated and can propagate for millimeters. A result of the coupling of SPPs within a multilayer HMM system is the propagation of highly confined wavevector modes, called bulk plasmon polaritons (BPPs). Hyperbolic metamaterials have the potential to act as ultra-high sensitivity sensors because they support high-k modes and high density of photonic states. Other plasmonic platforms such as surface plasmon resonance (SPR) sensors have already been harnessed as nanosensors. This research project will demonstrate that the excitation of BPPs using our custom-built HMMs can provide extremely precise detection of biological molecules, including prostate-specific antigen.
Abstract

Brominated flame retardants (FRs) are under scrutiny for their toxicity, creating a need to identify a low toxic, environmentally friendly FRs. Bio-based additives are evaluated as potentially suitable replacements for brominated FR additives, especially for foam products, in the present works. The foams not only need to be flame retardant, but ideally should not leave a large carbon footprint. Polyurethane foams are not only flammable, but exhibit extremely low rates of degradation when buried in the landfills. A potential replacement for such foams could be polymer aerogel; these materials possess low thermal conductivity, high porosities (>90%), and tailor mechanical properties. Results of formulation and flammability testing of a number of bio-based FR systems in polymer aerogels are reported in this work.
In 2013, carbon dioxide accounted for 77% of our nation’s electricity sector emissions, which is 31% of the U.S. total for all gas (United States Energy Information Administration, 2014). Meanwhile, only 13% was from renewable energy sources. Every year, millions of tons of CO2 contaminate our air. This research involves the basic introduction of Redox Flow Batteries, energy storage devices which store high amounts of energy in liquid electrolytes which flow through a battery of fuel cells. Developed over the last 40 years, in a cost-efficient, scalable, and especially pollution-free manner, they compete against burning coal to meet our high energy demand as the world’s second highest power consuming country (EPA, 2013).
Hydrogels are valued for their resemblance to native extracellular matrix (ECM); however, traditional hydrogels are inherently weak. Herein, we present a fabrication method for the manufacture of mechanically robust hydrogels based on poly(ethylene oxide) (PEO) reinforced with poly(ε-caprolactone) (PCL) nanofibers. A one-step composite processing method based on traditional multilayer coextrusion results in a matrix/fiber (PEO/PCL) composite, and through post-processing covalent chemistry the PEO is crosslinked to form an in situ fiber reinforced hydrogel. We compare this in situ fabrication method with traditional electrospun fiber reinforced hydrogel composites. The elimination of organic solvents during fiber processing and the resulting process simplification greatly improves the industrial appeal of hydrogel manufacturing.
Retinoic acid (RA), a vitamin A metabolite, will bind to the nuclear receptor retinoic acid receptor (RAR) via the cytoplasmic binding protein cellular retinoic acid binding protein II (CRABP-II). This signaling pathway leads to cell death. However, in certain cancers, the overexpression of FABP5 causes RA to activate the nuclear receptor peroxisome proliferator-associate receptor \( \alpha/\beta \) (PPAR \( \alpha/\beta \)), thus inducing cell proliferation and growth. The goal of this research is to find an inhibitor for FABP5 which would then force RA to bind with RAR to promote cell death, thus becoming a natural cancer preventive. In order to find the substitution for RA, a binding assay and a viability assay have 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 significant decrease in binding affinity. The viability assay was done with the same derivatives and the results showed a lack of dose response for the methylated derivatives. With this significant change, more analysis can lead to further understanding of the structure activity relationship. In the future, more experimentation will be done with these compounds to better understand the structures suited for binding with FABP5.
### Abstract

The purpose of this experiment is to synthesize iPrAuCl. iPr is an organic Lewis base that binds to Lewis acids, such as gold(I). iPrAuCl is a versatile reagent in gold chemistry. Upon completion, synthesis of gold(III) complexes involving iPr will be performed. Aryl derivatives of the gold complex are sought. The new complexes will be characterized by their structural and photophysical (light-emitting) properties.
**Title**: Sustained Release of siRNA from DEX-MAES Hydrogels for Use in Tissue Engineering

**Author Status**: Undergraduate student

**In Graduate Student Competition**: True

**Author Affiliation**: Case Western Reserve University

**Category**: Engineering and Computer Science

**Published?**: False

**Presentation Type**: Poster

**Elevator Speech**: Precisely controlling the delivery of bioactive factors, such as siRNA, has remained a challenge in stem cell-based tissue engineering. We have developed a delivery system that enables temporal control over the release of siRNA from chemically modified hydrogels. This system may provide a valuable platform for future use in tissue engineering.

**Key Words**: siRNA, Hydrogels, Mesenchymal Stem Cell, Tissue Engineering, Delivery

**Abstract**

Short-interfering RNA (siRNA) is a double stranded nucleic acid that is capable of silencing gene expression post-transcriptionally via targeted degradation of specific mRNA. siRNA has recently been employed in the fields of tissue engineering and regenerative medicine as it can inhibit the expression of proteins that can alter differentiation pathways of mesenchymal stem cells (MSCs). Previously, our lab has developed polymer-based hydrogels that can locally control the delivery of siRNA to MSCs in vitro by regulating affinity interactions with - and/or degradation rate of the hydrogels. In this project we developed the first hydrogel delivery system that enables temporal control over the release of siRNA through the direct covalent tethering of siRNA to the hydrogels. Thiol-tagged siRNA was covalently bound to acrylated dextran via a Michael addition reaction, then the extra unreacted acrylate groups of dextran were crosslinked via photopolymerization to produce hydrogels. This bonding resulted in the delayed release of bound siRNA from DEX-MAES hydrogels compared to the burst-release fashion of unbound siRNA. Furthermore, GFP-knockdown studies verified that siRNA released from these hydrogels maintained its bioactivity, despite the chemical modifications. This system may provide a valuable platform for siRNA release to regulate stem cell fate for tissue engineering.
Rhododendron are a genus of over 1000 plants that inhabit Asia and the Southern Highlands of the Appalachian Mountains in North America. These environments are diverse in terms of their niche availability. Thus the Rhododendron are a powerful study system for asking how a single genus of plants has adapted to a wide array of living conditions. For example, these species have a wide range of cold tolerance traits, root morphologies, and interactions with root mutualists. By studying the trnL chloroplast gene and the non-coding chloroplast region, trnL-trnF, across multiple species, we can begin to estimate the manner in which these plants evolve and establish a possible pattern for plant evolution. We collected accessions from the GenBank database for over X00 plants. We aligned these regions using the MUSCLE alignment algorithm in the MEGA (version 7) platform. We used maximum likelihood to estimate the phylogenetic tree, a report one of the most comprehensive estimates of Rhododendron phylogenies to date.
Oropharyngeal candidiasis (OPC; thrush) is a fungal infection caused by the overgrowth of a type of yeast called Candida albicans. This is more commonly found in subjects with risk of immunodeficiency such as those with HIV/AIDS, those under chemotherapy, etc. The defense against C. albicans varies, however one such defense involves a protein called Interleukin-17A, or IL-17A. The presence of the infection caused by C. albicans activates T helper cells including T helper cell 17, or Th17. Th17 then secretes IL-17A in response to the infection. IL-17A is a proinflammatory cytokine that increases chemokine production in response to pathogens invading the immune system. It recruits neutrophils and monocytes to the site of infection and inhibits the dissemination of the C. albicans. The purpose of this experiment is to determine whether there are changes in the innate responses to C. albicans if IL-17A is not present. Wild-type B6 strain mice will be compared to IL-17A knockout mice that cannot produce IL17A. From this data we will be able to further understand the importance of IL-17A in relation to the response against C. albicans.
Objective: Recognition memory is important processes in understanding the fundamental mechanisms underlying retrieval of environmental information. Previous studies have demonstrated that undergraduate individuals have a conservative bias when dealing with visual stimuli (i.e. pictures of paintings) when compared to words. The aim of this study is to test the efficacy of short-term memory recognition and recall between pairs of stimuli (one painting, one word) and whether there is a conservative bias in the recall of paintings.

Methods: 20 Undergraduate students recruited from Case Western Reserve University were shown a study list of 70 stimuli, exposed for 3 seconds each, half of which were composed of pictures of paintings and half were composed of words. A forced choice recognition test was employed, where pairs of stimuli (one painting and one word) were shown. Four categories were created (PictureNewWordOld, PictureNewWordNew, PictureOldWordNew, PictureOldWordOld) in relation to the recognition test. A followup study was then conducted with 15 undergraduate students. Again, a study list composed of 70 stimuli were shown. Pictures of paintings in the followup were exposed for 1 second, while words were exposed for 3 seconds. A t-test analysis was created to determine statistical significance.

Results: Participants displayed a conservative bias towards pictures of paintings; Recognition memory and recall of pictures of paintings was independent of recall for words. Using the Signal Detection Theory, participants experienced more misses for paintings rather than false alarms. T-test analyses resulted in a statistical significance of 0.00 and 0.004 respectively.

Conclusion: Conservative bias affects recall of paintings but not words. Currently, our understanding of why this occurs is limited.
Abstract

Recently, the extracellular matrix (ECM) has been shown to play a larger role in cellular differentiation than previously thought. ECM is vital to the function of many cellular processes in the human body – cell migration, cell differentiation, and cell structure. Factors such as adhesion to the ECM, ECM stiffness, and topography of ECM components all have a role, and variance in composition and concentration within various tissue systems have led to differing ECM properties and alternate cell differentiation pathways. Of special interest to us is how dynamic modulus change can affect cell differentiation. Previously reported research on mesenchymal stem cells demonstrated that stiff substrates promoted bone differentiation whereas soft substrates promoted adipocyte (i.e. fat cell) differentiation. Herein, we present preliminary findings on the short-term effects of dynamic stiffening on mouse-derived MC3T3 progenitor cells. Dynamic stiffening of ECM was mimicked by tensile stretching of melt co-extruded fibers. Tensile stretching and testing of the fiber moduli confirmed an increase in stiffness with pulling. Differential Scanning Calorimetry also confirmed an increase in crystallinity of the fibers post pulling. Employment of a two-step photochemical and click chemistry sequence was then utilized to attach RGD onto these fibers with subsequent seeding of MC3T3 murine cells. Confocal imaging of the samples indicated a definitive change in cell morphology at different drawing ratios.
Elevator Speech

In the past it has been difficult to take in vivo spectra from a single larva of Tenebrio Molitor. Modern instrumentation allows for multinuclear spectra which shows the effects of hypoxia and poisoning on the larva.

Key Words

Multinuclear MR
Tenebrio molitor
Metabolism

Abstract

With modern instrumentation, excellent in vivo 1H, 2H, 13C and 31P NMR spectra can be obtained from a single larva of Tenebrio molitor (the meal worm). This affords non-invasive measurements of cell bioenergetics. We report results obtained in normal and pathological (hypoxia and poisoning) conditions. Production of nascent metabolic water can readily be measured by dynamic deuterium magnetic resonance (DDMR) in organisms fed deuterated glucose. In contrast with experiments on mice, in larvae we only see the evolution of metabolic water (they are consuming the glucose immediately after ingestion). Significant differences were found in the extreme cases of hypoxia caused by drowning in water, heavy water, and alcohol. The larva completely recovered after drowning in water, but not after immersion in D2O and alcohol. DDMR may become a strong complementary method to, or even replace, the expensive (and invasive) FDG-PET test. Also, it would help to better interpret fMRI.
Generally, per-capita population growth rate is negatively correlated with population size, due to competition for resources amongst individuals in large populations. Some populations, however, demonstrate a phenomenon known as an Allee effect, in which this typical relationship is reversed at low population sizes, and there is a positive correlation between per-capita population growth rate and population size. For social animals, Allee effects can also act at the group level, meaning the positive correlation is between per-capita population growth rate and group size. Allee effects are categorized as component or demographic based on whether one component of the individual's fitness or whether the individual's total fitness displays positive density-dependence. The African wild dog (Lycaon pictus) is a highly social carnivore and obligate cooperative breeder that lives in groups of varying sizes called packs and is known to have a multitude of component Allee effects at the group level. It is less clear, however, whether such group level Allee effects translate into a demographic Allee effect, and thus result in a heightened extinction risk at low population sizes. We developed a stage-structured, mathematical model of an African wild dog population and tested it against a comparable model which eliminated packs from the population to determine the effect that group structure has on the population dynamics of the African wild dog. Our results show that packs act as a buffer for the population, allowing it to persist over a wider range of parameters, and longer for any given set of parameters. This is because mechanisms affecting birth and mortality are influenced by group size more strongly than population size. The results also imply that conservation efforts should be more concerned with the size of packs as opposed to the population size.
Slide ring gels are mechanically cross-linked polymers that are flexible, robust, and super-absorbing materials. The cross-links in this interesting class of materials consists of multiple polymer chains threaded through ring-like cyclic molecules and as such these macrocycles act as mobile crosslinks have the ability to slide along the polymer chains. The slide ring gels being targeted in this project are double-threaded rotaxanes and the synthetic approach to these systems is to use a metal ligand complexes to template the interlocked architecture. The end-groups of this structure are then capped with bulky molecules big enough to prevent the ring from dethreading. Removal the the metal ion template then yield the targeted slide ring gels. To create our rendition of the slide ring gel, we must construct macrocycle complexes, stopper groups, and threads. A significant component in assembling both macrocycles and threads is bis(benzimidazolyl)pyridine (Bip). Over the past several months, we have successfully synthesized both Bip-containing threads and macrocycles and shown that these materials can indeed be assembled into gels.
Modern and Contemporary History of Chinese Cities Development

The research analyzes the history of Chinese cities' development and states personal suggestions and comments on Chinese cities' development. China's unique developing will diversify the world's culture and change the international situation.

Abstract
China suffered a miserable and unforgettable period from the First Opium War to the foundation of People's Republic of China. However, China has revived since the new government came to power. Chinese cities experienced declining and booming in the past centuries.

The content of the paper is designed based on books about Chinese cities and self-experiences. The paper demonstrates how Chinese cities developed after invasion and self-adjustment in terms of specific periods. From the First Opium War to the foundation of Republic of China, Western invaders took over Chinese cities and initiated industrialization and modernization. In the period of fighting against Japan and Civil War, Chinese cities were largely under the control of the Nationalist Party who designed cities based on western capitalism. After Mao Zedong came to power, China experienced the Great Leap Forward and Cultural Revolution which led Chinese cities to an improper development. After Mao Zedong passed out, Deng Xiaoping carried out the Economy Reform and vitalized Chinese cities again. Several important cities in China are listed out to discuss the development from four aspects: economy, culture, industrialization, and transportation.

China has improved its international status and reputation since the Economy Reform. Large cities like Shanghai, Beijing, and Hong Kong attract people all around the World. However, Chinese cities' development has always been a potential risk and has been criticized by national and international medias. On the one hand, the booming of the cities sacrifices environment and plenty of resources. On the other hand, China has become one of the most powerful countries in the world and is stilling booming. Anyways, only Chinese people will find the best way to develop the cities because foreigners do not understand Chinese history and China's national conditions.
This research is aimed at discovering what happens over time to the common filler materials in pharmaceuticals in storage in the consumer’s care, where they will experience conditions like heat or humidity. The consumer often does not take the same care when storing said pharmaceuticals as the manufacturer or distributor might, and these factors are the ones we wanted to take into account.

This information was determined using thermogravimetric analysis (TGA). Samples of calcium oxalate, magnesium stearate, and calcium carbonate were run their weight loss over time as they were heated them past their degradation temperatures was observed. Derivative analysis was performed on the data and the positions of the peaks in the first derivative were noted as places where the structure of the molecules changed as degradation of certain structures occurred. Detailed analysis of the structures of these fillers and the temperatures at which their first derivative peaked defines which structures are released from the molecule at what points. This information can be used to determine whether or not harmful structures to the pharmaceuticals that these fillers are in will be released as the fillers degrade in non-ideal storage conditions.

Water desorption was also observed using derivative analysis of the TGA graphs of the fillers, and the amount of water present in each filler can be determined, as well as the effect that this might have on the efficacy of the pharmaceutical. Using the concept of time-temperature superposition, conclusions can be drawn from the TGA of each filler about their longevities and about whether or not they are effective fillers in pharmaceutical drugs.
Abstract

Each year hundreds of tons of polymer are produced for use in commodity and specialty materials. Disposable cups, tires, glue, biodegradable sutures, and contact lenses are all manufactured from synthetic materials. Currently available polymers are limited in their backbone and side group functionality. This lack of functional diversity inhibits the access of desirable thermal, mechanical, electrical, and degradation properties. New materials properties require the synthesis of unique polymer backbones from novel monomers. Silyl ketenes have been proposed as new monomers for chain growth polymerization. Both radical and anionic polymerization have been employed to access three backbone structures: polyketone, polyketene acetal, and polyester. Recent work has examined the effect of monomer to initiator ratio, reaction temperature, and solvent on polymer structure. Current work involves synthesizing and fully characterizing oligomers in order to understand polymer structure and determine backbone functionality. Moving forward the polymerization of various silyl ketenes will be examined to understand the effect of silyl group size on polymerization rate. Higher monomer to initiator ratios will be studied to assess if higher molecular weight polymers can be achieved.
Predicting the response of a specific type of cancer to a new cancer drug is a common problem in the fields of computational biology and oncological research. Recent advances in technology have made this problem more feasible. In particular, high-throughput technologies for identifying mutations and differentially expressed genes in specific cancer cell-lines have given scientists more data to work with.

In this project, we compared the accuracy of several commonly used predictive modeling techniques for predicting the lethality of the cancer drug SMAPs (Small Molecular Activators of PP2A). These models included Support Vector Machines, Decision Trees, and Logistic Regression. We provided each of our models gene expression data and SMAPs IC50 data from 185 cancer cell lines. We then used cross-validation to compare the accuracy of our models on cell lines they had not been trained on.
Joubert syndrome is a ciliopathy disease that affects the retina, kidney, brain, and liver. Of the many genes that lead to Joubert syndrome when mutated, we study the genes CEP290 and ARL13b in zebrafish. These three genes produce proteins that function in the ciliary transition zone of the photoreceptor in the retina, a region of the cilium that regulates protein trafficking. It is well established that mutations in multiple genes can modulate phenotypic expression in Joubert syndrome, suggesting that interactions between these genes affect the seriousness of the disease. We have found that adult zebrafish with mutations in CEP290 show slow, progressive photoreceptor degeneration and that mutations in ARL13b show shortened outer segments in larvae. We hypothesized that the retinal phenotype of a ARL13b, CEP290 double homozygous mutation would be worse than the retinal phenotype of CEP290 and ARL13b single homozygous mutants. We studied the retinal phenotypes of these mutants using immunohistochemistry on cryosections and histological plastic sections. It appears that we have found a unique phenotype for the double mutants. With the information obtained from our analyses comparing the mutant retinal phenotypes we hope to develop a better understanding of the ways that the proteins expressed by the mutated genes contribute to the pathology of Joubert syndrome.
Investigation of Neural Network Dynamics via Multiunit Recordings in the Buccal Ganglion of Aplysia

Our research will develop new experimental technique which more accurately identifies the individual motor neuron activity in the neural activity pattern by utilizing extracellular glass electrodes to compensate for current disadvantages of multielectrode array. This will provide a more accurate insight into complex neural network dynamics controlling specific behavioral patterns.

The marine mollusk sea slug Aplysia californica generates distinctive feeding behaviors with the buccal ganglion. The network of interneurons and motor neurons projecting to the muscles of the buccal mass has been previously identified by stimulating and recording buccal motor nerves. We are developing an experimental technique to investigate the contribution of each motor neuron in the ganglion to the network activity pattern by stimulating and recording single-cell activity using extracellular glass electrodes, recording motor nerves using suction electrodes, and recording active motor neurons’ locations in the ganglion using two-dimensional, high-density multi-electrode arrays. These data sets will then be analyzed using independent component analysis, spike-sorting algorithms, and reverse correlations between single units and the output of the buccal motor nerves. If successful, we will provide for the first time a more complete characterization of neural network dynamics controlling well-defined behaviors in a biologically relevant context.
Evidence of Tumor Suppression in Medulloblastoma Cell Lines

Abstract

Medulloblastoma is cancer of the cerebellum resulting in the growth of tumors. This cancer is fast growing and claims many lives each year. The focus of this project is to test various drugs and see if they can produce anti-tumorigenic effects in medulloblastoma cell lines. One specific type of drug used is statins. Statins are typically prescribed to patients with high cholesterol, as they block the activity of the enzyme HMG-CoA reductase, an essential enzyme in cholesterol production, but they have been shown to be effective in treating cancers as well. This project investigates the difference between administering drugs on the same day the cells are plated and the day following, to determine which produces more potent results. It also looks at the ability to reverse the damage done to cells treated with a statin drug, to determine which steps of cholesterol synthesis are critical for cancer cells. Overall, this project aims to validate the use of statins as a potential treatment for medulloblastoma.
Infertility is a health problem that affects many couples worldwide. Our hypothesis is that dysregulation of non-coding genes may lead to infertility. We have discovered some key long non-coding RNAs that may play a functional role in spermatogenesis. Our findings could establish a novel mechanism of mammalian infertility.

(1) ?Ahmad M Khalil and Jeff Coller, Book title: Molecular Biology of Long Non-coding RNAs (2013)?
In the U.S., binge drinking occurs in about one-third of pregnant women who consume alcohol. Prenatal alcohol exposure (PAE) can cause fetal alcohol spectrum disorders (FASD). In a recent study, 2-5% of first grade students presented with symptoms of FASD such as neurodevelopmental and cardiac defects. Alcohol increases oxidative stress so antioxidants were tested as candidate compounds for preventing the effects of PAE. Curcumin was chosen because it protected against ethanol cytotoxicity in an in vitro study. Quail was chosen as our model because of similarities in heart and brain development to humans. Toxicity studies were done using varying concentrations of Curcumin alone and then dissecting at stage 34 when the heart and brain have undergone major steps in morphogenesis. Specifically, abnormalities in head development (exposed brain lobes and smaller eyes) and body defects (open chest wall) were noted. The results of the toxicity studies showed a survival rate at or above 83% with the percentage of defects among survivors at or below 11.5%. The Curcumin was then added together with ethanol to the embryos and the survival rate was below 50% in most doses along with gross defect rates as high as 57%. The Curcumin plus alcohol survival rate was no better than the survival rate of embryos exposed to alcohol alone which was 50% with typically half the survivors presenting with abnormalities. Because Curcumin did not mitigate the effects of ethanol exposure, another antioxidant Epigallocatechin Gallate (EGCG) was tested due to its preventative effects against FASD in a mouse model. Our preliminary studies of EGCG toxicity have shown survival rates above 80% comparable to the survival of controls and abnormality rates around 16% or below. Future studies with EGCG will look at its interactions with alcohol and its role in mitigating negative developmental effects.
Background: Viral upper respiratory tract infections are responsible for complications of substantial morbidity and mortality worldwide 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 such as ARMS-I that targets 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 the 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 Election 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 has a 2 log reduction in the viral titer compared to control treatments. The barrier treatments that contained >25% of ARMS-I barrier components shows a >2 log decrease 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.
The melting behavior of iron alloy systems is fundamental to understanding how the metallic cores of planets and smaller solar system bodies formed and evolved over time. The lowest temperature at which melt is stable is particularly important because it places a lower bound on the temperature at which liquid metal can begin to segregate downward to form a core, and it defines the temperature at which the core becomes completely solid during later cooling of the body. In this study the eutectic temperature, at standard temperature and pressure, of the Fe-S-Si system was determined through experimental means by identifying textures indicative of melting undergone in heated samples. By doing this it was found that the eutectic temperature for the Fe-S-Si system is about the same as the Fe-S system, about 988 C, as opposed to past studies stating that it was around 965 C.
## Abstract

**Objective:** The purpose of this research is to develop speech recognition materials for young children (age 5 and older) with hearing loss. These materials will be used to objectively test device functionality for children fitted with hearing aids and cochlear implants with respect to the child’s speech recognition abilities.

**Methods:** Twenty lists of twenty sentences were constructed using words within a child’s lexicon and simple syntax structures. Each sentence includes four keywords that are used for scoring, e.g., The GRANDMOTHER BAKED SUGAR COOKIES (keywords in capital letters). Vocabulary used was taken from the Storkel and Hoover (2010) kindergarten/first grade lexicon to ensure that all words were within the linguistic abilities of young children. Sentences were analyzed for their syllabic count/keyword, syntax structure, and total affricate and fricative (high-frequency speech sounds) count to verify suitability for persons with varying forms of hearing loss, including high frequency hearing loss and to equate difficulty across the 20 lists.

**Results:** This research will result in twenty lists of twenty sentences that are similar in linguistic difficulty. Audio recordings of these sentences will be sent to Boys Town National Research Hospital in Omaha, Nebraska, where children’s recognition of these materials will be assessed while fitted with cochlear implants and/or hearing aids.

**Conclusion:** Speech recognition materials are an ecologically valid test tool for audiological testing, as it provides information about a person’s audibility and ability to use higher level speech cues (such as syntax and meaning). These materials will provide clinicians and researchers with age appropriate test materials to assess speech recognition abilities for children with hearing loss.
Incidence rates of Hepato Cellular Cancer (HCC) are rising quickly along with the obesity rate of this male dominant disease. For this reason, many of the HCC studies have been performed on male models. The goal of this study was to investigate the connection between obesity and HCC in ovariectomized and non-ovariectomized female mice in order to determine how HCC develops under normal and reduced estrogen levels. The study included eight groups of mice: 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 ovariectomized mice showed an increase in weight gain for both the HFLS and LFLS diets at early time points, but at later time points the HFLS groups showed a minimal difference in ovariectomized and non ovariectomized groups, while the LFLS groups continued to show a large difference in weight patterns. Therefore, the results show that estrogen plays a role in weight regulation of female mice. Preliminary data indicates an increased incidence rate of HCC in HFLS groups with ovariectomized mice developing HCC more frequently than the non-ovariectomized groups.
Abstract

Formation of blood clots requires small disc shaped objects called platelets to move from the center of a blood vessel to the vessel wall. The stiffness of the platelet plays a significant role here as the platelets are "batted" toward the vessel wall by the much larger red blood cells around them. For researchers interested in engineering synthetic platelets to augment clotting, a biomimetic synthetic platelet would need to match the stiffness of a naturally occurring platelet. To help in designing and producing such a synthetic platelet, we seek to measure the moduli of both non-activated human platelets and synthetic platelets. We’ve developed a procedure that uses atomic force microscopy operated in "peak force mode" to measure these moduli at various points across a sample. The commercial instrument outputs modulus modeling the indenter as either a sphere (Hertz model) or a cone (Sneddon model). We wish to calculate the moduli using a more sophisticated combined Hertz-Sneddon model. This requires extracting the signal (proportional to a load deformation curve) from the atomic force microscope using a high speed digitizer, and analyzing it using MATLAB code produced in our lab. We must also be able to map each load-deformation curve to a specific location on an imaged region of the sample. We have succeeded in imaging a test sample and then extracting several equally spaced curves along a single line scan of the image.
Acute Myelogenous Leukemia (AML), the most common type of acute leukemia among adults, consists of premature leukocytes that do not fully differentiate from stem cells or immature hematopoietic cells. Ideal therapeutics would lift this differentiation block, allowing cells to fully mature. Current treatment options for AML are toxic and yield a 33% 5-year survival rate. To identify potential, new AML therapeutics, a cell-based screening process was applied to a compound library. The HL60 (AML) cell line was used to test 1040 candidates to determine if the compounds would induce differentiation. Cells at a standard concentration were aliquoted in 96 well plates, and each compound tested separately. Treated cells were incubated for 4 days, then assayed for differentiation. The screening identified nine compounds that induced strong differentiation. These compounds underwent additional testing on the OCI-AML3 cell line. The compound 5H7 yielded 64% differentiation compared to 25% in a positive control. In the HL60 cells, 5H7 yielded 76% compared to 33%. HL60 cells treated with 5H7 were then tested for CD14 expression, indicating differentiation, by using flow cytometry; 90.17% of a cell surface marker of a type of mature cells was observed in 5H7 treated cells versus the positive control at 25.0%. To test cell viability, healthy leukocytes were treated with 5H7 and stained with Trypan Blue. 16% of treated cells were positive for Trypan Blue, compared to 13% of untreated cells. This suggests 5H7 is not toxic and has potential as an AML therapeutic. Future work will focus on determining mechanism of action.
Fructose intake has increased significantly in the last few decades. 15 million Americans consume 20% or more of their calories as fructose. Excessive fructose intake has been implicated in obesity, diabetes, and hypertension. Sugars are absorbed from the small intestine and reabsorbed from filtrate by proximal tubules via GLUT2 and 5. Expression and activity of GLUT2 and 5 are elevated by consumption of glucose or fructose. Glucose and fructose are also absorbed into blood against their concentration gradients via sodium-glucose linked transporters (SGLT) 1, 2, 4, and 5. SGLT-1 and SGLT-2 transport only glucose, whereas SGLT-4 and SGLT-5 transport both glucose and fructose. It is unclear whether a fructose-enriched diet increases expression of SGLT-4 and 5. We hypothesized that a 20% fructose diet increases the expression of SGLT-4 and 5 in the kidney, thereby increasing fructose reabsorption. Western blotting was used to compare expression of SGLT-4 and 5 in proximal tubule suspensions from rats that received a normal diet and a normal diet with 20% fructose in their drinking water. The antibody used to recognize SGLT-5 in Western blots showed a single band at 64 kDa, the predicted molecular weight. Expression of SGLT-5 in proximal tubules from rats on normal diet was 0.77 ± 0.05 arbitrary units (a.u.) while that in proximal tubules from rats receiving fructose was 1.23 ± 0.09 a.u., 59.1% greater than the control group. The antibody used to recognize SGLT-4 showed a single band at 74 kDa, the predicted molecular weight. Data on SGLT-4 expression is currently being analyzed. Our preliminary conclusion is that dietary fructose increases SGLT-5 expression in renal proximal tubules. This may account for the increase in fructose reabsorption by this segment in animals whose diet contains fructose. Diet-induced elevation of fructose reabsorption may raise plasma fructose concentrations and contribute to the obesity, diabetes and hypertension caused by fructose.
In modern cosmology, two questions that we must yet answer are “What is the topology of the universe?” and “What is the size of the universe?”. Since it is impossible to traverse the universe in its entirety, we seek to use the information we have already, the Cosmic Microwave Background (CMB), to extract this information. We have devised a new approach to this problem, utilizing the Weyl conjecture, but first we must establish whether it is valid for topological domains. This conjecture relates the density of eigenvalues to the volume and surface area of our manifold. If we find that this conjecture holds, we will investigate methods to extract the eigenspectrum from data collected from the boundary of our domain. Furthermore, we will examine how small the observable domain can be relative to the fundamental domain, while still obtaining useful data. This method will be a proof of concept for analysis of actual CMB data.
Anemia is a common morbidity of chronic kidney disease, and has been linked to increased hospitalizations and decreased quality of life in the pediatric population. Erythropoiesis stimulating agents (ESA) are the treatment of choice for anemia in dialysis patients, but have been linked to increased cardiovascular events and account for a large percentage of the expenditures in dialysis care. At our center, we set the target hemoglobin level for dialysis patients between 10 and 12 g/dL to balance the cost and benefits of ESA. In order to control hemoglobin levels more effectively, we developed an algorithm for dosing of ESA. The goal of this study is to determine the efficacy of the algorithm maintaining patients within the hemoglobin target range. A secondary goal of this study is to determine how well the algorithm was followed and to determine if there was any cost savings in ESA expenditures when the algorithm was adopted. By finding an effective algorithm, the management of anemia in the hemodialysis population may improve and Epogen usage by his department can be more cost-effective.
Within the field of global health engineering and anthropology are two very distinct disciplines that rarely interact with each other within the University setting. However they play important roles within global health as well as other fields. Taking advantage of a collaboration between the two disciplines at Case Western Reserve University (CWRU) the importance of interdisciplinary work was observed. The study began with three distinct goals: to observe individual problem solving approaches between anthropologists and engineers; to see how engineers and anthropologists work together in teams; and to observe the opportunities and challenges that arise in a cross-cultural interdisciplinary context. The study was done by conducting ethnography as an enrolled student in the ANTH 376/ENGR 397. Participant observation also included involvement in the Global Health Design Collaborative (GHDC), the EBME 380 design team for medical waste disposal, as well as going on the field trip to Uganda. Interviews were conducted among students in ANTH 376/ENGR 397, students in GHDC, students who traveled to Uganda last year, students and faculty from Makerere University in Uganda as well as faculty associated with the ANTH 376/ENGR 397 course. Communication was recognized as a challenge not only between anthropology and engineering students but between CWRU students and Makerere University students as well. The collaboration between engineers and anthropologists resulted in more innovative solutions, greater respect between the disciplines and ultimately a unique learning opportunity. The collaboration between engineers and anthropologists, a course and a student organization, as well as an American and Uganda University unique, however I do not believe it has resulted in unique results. Further research is encouraged in order to confirm this hypothesis.
The African American genome is shaped by an extensive ancestral diversity and recombination each generation that carry important health implications. As genome-wide association studies flourish, they are becoming increasingly important as a tool to help researchers understand the patterns in human variation and the role genetic recombination plays in disease. These studies have identified a large number of single-nucleotide polymorphisms associated with disease phenotypes, drug resistance and treatment outcomes. Utilizing research on whole-exome and targeted sequencing, I characterized genetic characteristics found commonly within African Americans determine if there is a genetic basis for conditions that occur more often in African Americans. For instance, several studies have identified single nucleotide variants and mutations in African American patients with colorectal cancer to that are correlated with higher incidence of aggressive colorectal cancer tumors regardless of age, weight, or socioeconomic status. In this review, I summarized the available data on similar genome wide association studies and used this to highlight ways in which these genomic studies have led to advances in accurate diagnosis, effective clinical management, and specialized treatment to improve the health of African Americans. Although there are unique challenges of performing research within the African American community because of significant genetic diversity and complex population history, population-based approaches for investigating the genetic makeup of African Americans will yield useful information about the pathophysiology of disease, and have implications that can transform personalized medicine.
Electrospun magnetic fibers were fabricated via high voltage electrospinning method. The size and morphology of the polymer fibers were optimized by varying the polymer concentration, applied voltage and electrospinning rate. The polymer fibers were evaluated using scanning electron microscopy. To incorporate the iron oxide nanoparticles, the oleic acid capped iron oxide nanoparticles were first transferred to an aqueous solution through a ligand exchange method before dispersing in the polymer solution. The size, morphology and the magnetic hyperthermia performance of the resulting magnetic polymer fibers were compared to polymer fibers without iron oxide nanoparticle incorporations. Potential applications for the magnetic fibers include water filters, sensing materials and heterogeneous catalysis. In addition, these refined techniques can be used for similar nanocomposites.
Nuclear Quadrupole Resonance (NQR) is a useful form of spectroscopy. It can be used to quickly identify if a sample contains a molecule. Possible uses include identification of counterfeit drugs. This is a problem in third world countries where they lack strong regulation. However, NQR suffers from a weak signal that can make identification difficult. A system that can easily increase the signal is needed in order to further research into NQR. I can accomplish this through prepolarization.

Prepolarization of a sample can boost the signal by up to an order of magnitude. Construction of a prepolarization device would allow much more research into this field.

This project will consist of establishing a magnetic field, moving a sample, and optimization of the process. Putting these three parts together successfully will enable an automatic and accurate NQR device. Further research into NQR will then be possible.
The stria vascularis is a highly vascularized epithelial structure localized in the lateral wall of the cochlea. It produces endolymph, a potassium rich fluid responsible for the positive endocochlear potential necessary for normal hearing. The stria vascularis is composed of three distinct cell types: marginal cells of epithelial origin, intermediate cells derived from the neural crest, and basal cells derived from the otic mesenchyme. Strial degeneration is the cause of more than 30% of all age related hearing loss or presbycusis, while developmental strial defects contribute to various inheritable deafness syndromes such as Hirschsprung disease. However, very little is known about the development of the stria, the causes of strial degeneration, or the molecular identities of the different strial cell types. To better understand the development of the stria, we generated RNA-Seq libraries from genetically labeled intermediate cells obtained from neonatal mice (an analogous auditory system to humans). This experiment allowed us to identify genes that are highly expressed in intermediate cells compared to other cell types in the lateral wall of the cochlea. In this work we selected a subset of these genes based on their significance in intercellular communication and potential role in strial development: Slitrk1, Slitrk5, Cck and BDNF. We validated their expression in the cochlea by performing in situ hybridizations on Slitrk1, Slitrk5, Cck, and BDNF, genes chosen for their important role in intercellular communication and strial development.
### Abstract

Alzheimer’s disease (AD) is the most common form of dementia among an older population. Amyloid plaques and neurofibrillary tangles are the pathological hallmarks found within AD brains. AD affects primarily cholinergic neuron and there is a lack of acetylcholine within the limbic system. The decrease of this neurotransmitter affects higher cortical functions, memory and learning capabilities. The current treatment for AD involves specific drugs that inhibit the degradation of acetylcholine within synapses but these medications often just great the cognitive symptoms of the disease and not the underlying disorder. Many different studies have been done to research the affects of a lack of acetylcholine on AD brains as well as how different receptors play a role in the development of the disease. Nicotinic acetylcholine receptors (AChRs) are highly expressed in brain regions important for cognitive processes and memory functions. There are many other receptors that also interact with acetylcholine which impact AD brains. Acetylcholine receptors and acetylcholinesterases are examine and compared to see where AD research can be taken in terms of treatment and creation of medication to improve symptoms.
Abstract

The β-catenin is a protein that links cadherins and F-actin filaments of the cytoskeleton of a cell. This binding acts in the form of a catch bond, where a force must be present for the bond to form. These bonds were found to have much longer lifetimes when subject to forces of 8 pN. At 10 pN, the bond lifetimes decreased back to low levels. The force on cadherin-catenin complexes results in a change in the protein’s structure, causing it to rotate and increasing its length. This transitions them into more strongly bound states. β-catenins also form a catch bond with the protein vinculin. When the β-catenin is under 5 pN of force, the bundled β-helices unfold into a linear chain, exposing the vinculin binding site on the β-catenin and allowing the vinculin to bind more easily. Under 12.5 pN of force, the β-helices unfold more, and under 23.3 pN, they unfold still more. However, the exact relationship between the bond strength and the applied force is not well understood. Here we develop a coarse grained Hamiltonian model to simulate the bond lifetimes under force.

Elevator Speech

Understanding catch bond systems is crucial to understanding how cells interact with each other. Cell to cell adhesion is important in many ways, and could lead to more information on cell structures within the body, and how cancer spreads.

Key Words

Biophysics

Catch Bonds

Coarse Grained Hamiltonian
**Title**: Simulation of ant seed dispersal mutualisms can give predictions of coexistence and community diversity

**Author Status**: Undergraduate student

**Author Affiliation**: Case Western Reserve University

**Published?**: True

**Elevator Speech**: Myrmecochory is an important mutualism that affects how certain plant species disperse throughout an ecosystem. Dispersal mode affects plant species' ability to coexist with other species in the community and this research could assist conservation efforts as well as facilitate understanding of the role of climate change in this system.

**Abstract**: A basic question when studying community ecology is "what mechanisms govern species coexistence?" One factor that could shed light on how species coexist is dispersal. Dispersal mechanisms alter patterns of spatial arrangement among individuals and change the relative degree of interaction occurring within and between species. Understanding how different species coexist could also assist land managers in maintaining or restoring native plant community diversity. Ant mediated dispersal (also known as myrmecochory) is an important mutualism exhibited by many seed-bearing plants. Ants are generally more attracted to seeds that have larger elaiosomes, and are therefore more likely to disperse those seeds. Aphaenogaster picea ants are known to spread the seeds of Viola pubescens and Trillium erectum plants. The choice of which seed to disperse can change due to a variety of factors, but it seems as though bigger seeds leading to a bigger elaiosome are more attractive to the ants. There is an interesting trade-off here though, because although Trillium have the larger seeds, they do not make their seeds until they are much older than the Viola. Using the programming language R, we created a cellular automata simulation to model this system in a 500x500 environment over 100 years. The main variables included in this model were plant age, competition for space, fecundity, and dispersal mode. Incorporating the trade-off between seed size and seed number allowed us to make coexistence predictions in the system. These predictions could be tested in empirical systems and empirical data could be used to refine the modeling approach. What these results give us is a way to interpret the importance of ant-mediated dispersal on the community dynamics of plant communities being affected by this interaction. Furthermore, this may have applications to understanding how disturbance and climate change affect these complex interactions.
Innovative spintronics applications rely on the development of corresponding spin measurement techniques. A recent paper by Berezovsky et al provides a non-demolition technique to observe spins in nanocrystal semiconducting quantum dots (NCQD) that may prove useful in realizing useful application [1]. This method uses Faraday Rotation (FR) to apply spin-dependent optical transitions. Excitation of an excess electron using resonantly absorbed circularly polarized beam (left or right-handed) limits the allowed spins in the conduction band in accordance with Pauli exclusion principles. If an excess electron is excited using left-handed circularly polarized light, only right-handed light produces an antiparallel exciton state. We project the spin state onto a linear polarized beam by phase shifting its circular polarization components. This preserves the spin state allows us to observe electron spin precession when placed in a transverse magnetic field. Better understanding the spin mechanics in semiconductor materials will provide greater insight into how spin may be applied in more complex systems.

Previous methods using Faraday Rotation to measure spin coherence in NCQDs at room temperature produce signals on the order of tenths of degrees, where useful application would require signals on the order of degrees. These low, noisy signals are attributed to low coupling between the excited spins and the probe beam. Our experiment introduces an optical microcavity into this standard FR experiment to generate larger spin measurements. We use a hemispherical geometry for our microcavity in order to ensure localization of cavity modes. The optical microcavity generates a localized optical field, which translates to a greater number of interactions between the excited electrons and the linear probe beam. Increasing the number of interactions progressively increases the measured phase shift and corresponding spin signals.

Software Tools for Classifying Behavior from Neural Patterns

Automated identification and analysis of behaviors from extracellular recordings is a crucial step in efficiently turning laboratory data into interpretable results. However, software tools to accomplish this are under represented. This poster presents software developed in Mathematica to automate some of that analysis.

Neural patterns driving even simple behaviors can be very complex, and identifying neural correlates of behavior can lend insight into their analysis. Without statistical metrics and automated analysis to separate data entries of interest, recordings of neural patterns obtained in the laboratory can be difficult to interpret. By applying Mathematica’s ability to functionally work with patterns and analyze large datasets, it is possible to quickly and efficiently identify data of interest. To develop these analysis tools, we study neural correlates of feeding behaviors of the marine mollusk Aplysia californica. We have developed two sets of custom Mathematica software which will be applied to the dataset gathered for Cullins et al. 2015a,b. The first software toolset takes in raw extracellular voltage data and identifies the start and stop times of the activity of functionally relevant motor neurons and muscle activity. The second software toolset formats the data, calculates the duration of activity for each unit and passes the data through several clustering and plotting algorithms. Preliminary results suggest that this method is effective at discriminating behaviors, with several distinct distributions found for unit activity that are particular to biting or swallowing. These preliminary findings raise the distinct possibility of generating classifying functions which could further automate behavior identification. These analysis techniques will be of general interest in neuroscience for identifying patterns in neural data.
Severe trauma is the leading cause of death for individuals between the ages of 1 and 44, and subsequent hemorrhaging is the most common cause of post-traumatic mortality. Hemostatic nanoparticles offer an opportunity to reduce bleeding and improve mortality following traumatic injuries by accelerating the clot-formation process. PLGA-PLL-PEG cRGD nanoparticles synthesized using a nanoprecipitation method were administered intravenously into porcine patients following resection of the left lobe of the liver. Plasma samples were collected before and after injury and analyzed using C3 and C3a complement activation assays and correlated with vitals surgery data to quantify immune responses. Subsequent statistical and graphical analyses, including the Pearson’s Product-Moment Correlation Coefficient (PPMCC) and a four-parameter logistic regression suggested the presence of immune responses to some of these treatments. Observed statistical relationships between C3 and C3a concentrations, blood loss, and time-of-death seemed to confirm an adverse immune response to hemostatic nanoparticle treatments. Although hemostatic nanoparticles appear to reduce bleeding in these porcine patients, this study identified immune responses that may be limiting the effectiveness of these treatments. Future work focused on optimizing the poly(ethylene glycol) chain density and zeta potential of these nanoparticles to minimize immune responses in vitro and in vivo offer opportunities to maximize the effectiveness of hemostatic nanoparticles in porcine liver injury models.
The purpose of our project is to properly analyze stress in a patient during the ICU process. The hope is to combine buttons and a set of questions for the patient to answer to gauge the stress levels they are experiencing. In order to prove this method, we will be comparing the results to separate tests that have been proven to measure stress levels.

Key Words
- Stress Measurement
- Buttons
- Communication System

Abstract
Surgical ICU Augmented/Alternate Communication System for Stress Measurement

Winston Eng, Department of Biomedical Engineering; Amy Goldberg, Department of Biomedical Engineering; Yuki Hino, Department of Biomedical Engineering; Brenton Jennewine, Department of Biomedical Engineering; Quinn Shue, Department of Biomedical and Mechanical Engineering.

The goal of this project is to measure the stress of a patient coming out of surgery in the ICU. This project evaluates two methods of stress measurement: patient to nurse communication as well as quantitative tests based on vital signals. In order to improve patient to nurse communication, one goal is to create a question list as well as noninvasive buttons that the patient can use to respond with. The buttons will be wireless, sturdy, and have intuitive use in order to minimize giving the patient any additional stress. The responses from the patient will help the nurse gauge the general stress level of the patients. In order to assure that the stress results from the questions truly depict the stress the patient is feeling, the results will be cross-referenced and validated with another quantitative test, an electrocardiogram. The ECG will measure the patient’s heart activity. These vital measurements can then be used to understand the stress a patient is feeling. By comparing the quantitative test with the patient questionnaire, the goal is to improve patient stress communication to the nurse in the ICU.

Project Mentor: Professor Colin Drummond, Department of Biomedical Engineering
Beliefs, Resiliency, and Experiences with Intimate Partner Violence

Finding cognitive correlates for intimate partner violence perpetration and victimization could help guide interventions to improve outcomes for survivors and prevent future abuse. In the present study, we explore whether the way individuals think about the world and deal with stress is related to their experiences with IPV.

Intimate partner violence (IPV) is a prevalent social and public health issue that impacts men and women everywhere, including on college campuses. Theory and literature to date suggest that survivors of IPV and other traumas develop new schemata and expectations for the world, themselves, and others to accept, explain, and adjust to their experiences. An undergraduate sample completed a survey about IPV-V (victimization), IPV-P (perpetration), schemata/worldviews, and resiliency. The purpose of the present study was to see whether experiences with IPV were correlated to schemata and resiliency, and whether resiliency and/or schemata could in turn explain the relationship between victimization and perpetration. Although there were strong positive correlations between the two cognitive variables and between victimization/perpetration, the relationships between IPV and the cognitive variables were not significant. A sampling bias was found, with 75.9% of the sample identifying as female. After testing for gender differences, we found that the correlation between schemata and resiliency was significant for females but not for males. Implications for assessment, intervention, and future research are discussed.
Enterovirus 71 (EV71) is a positive sense, single stranded RNA virus that is a causative agent for neurovirulent Hand, Foot, and Mouth disease. This disease primarily affects young children and those with a compromised immune systems; infection is often acute and can lead to severe morbidity or death. Currently, there are no approved vaccines or antivirals against this virus. Due to the nature of EV71, it is important to understand how this virus works on a molecular level to promote infection. A critical early step in the virus' life-cycle is the use of an 5' Internal Ribosome Entry Site (IRES) to promote translation of viral proteins necessary for efficient viral replication and capsid production. An IRES is a highly structured RNA element that allows for translation to occur via a cap-independent mechanism through interactions with host proteins. A key step in initiation of translation in EV71 is the interaction of the UP1 domain of host hnRNP A1 with the Stem Loop VI (SLVI) domain of the EV71 IRES. This study focuses on understanding how SLVI is able to interact with the UP1 domain of hnRNP A1 on a molecular level. Understanding this interaction on the molecular level is important since it may serve as a possible site for drug design. In order to better understand hnRNP A1 and SLVI interactions, tyrosine fluorescence was used to monitor how binding of the upper apical hairpin loop of SLVI to the UP1 domain of hnRNP A1 impacts protein structure. Changes in tyrosine fluorescence in the UP1 domain was monitored as the upper apical hairpin loop of SLVI was titrated into free UP1. Preliminary data from this study indicates that a structural change occurs in the UP1 domain of hnRNP A1 upon RNA binding. Overall, data from this study indicates that the UP1 domain of hnRNP A1 binds to the apical hairpin loop of SLVI and RNA binding promotes changes in UP1 structure.
Abstract

*Aplysia californica* is an invertebrate that has often been used for the study of soft body biomechanics. One area of research involves the study of *Aplysia*’s complex feeding apparatus, the buccal mass. A previously developed model indicates that the movement of an internal structure, the radular stalk, towards and away from the surface of the feeding grasper is primarily responsible for the grasper’s opening and closing behavior (Neustadter, D. M., Drushel, R. F., Crago, P.E., Adams, B. W. & Chiel, H. J. (2002). “A kinematic model of swallowing in *Aplysia californica* based on radula/odontophore kinematics and in vivo magnetic resonance imaging.” Journal of experimental biology, 205, 3177-3206). In addition, we hypothesize that movement towards and away from the anterior part of the feeding grasper (known as the prow) plays a role in opening and closing behavior. To test this hypothesis, the radular stalk within feeding graspers of adult *Aplysia* were fixed in place (using glue) to achieve the wide open shape proposed by the original model. In three preparations, opening and closing was induced pharmacologically and video frames of 28 openings were measured using the visible closure point of the radular halves as a reference point. As controls, pharmacologically-induced opening and closing movements of sham-operated and un-operated graspers were also measured. The results showed a significant change in opening and closing behavior in preparations in which the radular stalk was kept in a fixed open position. This supports the hypothesis that movement towards and away from the prow is likely to be involved in opening and closing behavior.
### Key Words

- Rheological
- Nanotubes
- Nylon

### Abstract

The goal of this project is to characterize mechanically and rheologically a Nylon 12 resin with loading levels from 0.035% to 2% functionalized carbon nanotubes. Mechanical properties will be characterized utilizing tensile testing following ASTM standards and Young's elastic modulus will be the property of focus. Rheological characterization will be conducted utilizing melt flow index, parallel plate, and cyclic torsion testing. Melt flow index will provide a basic flow property of the materials for viscosity comparison. Parallel plate rheometry will provide the inherent material properties, $G'$ and $G''$, at the melt temperature of the material to give insight on the ability of the material to store and relax energy. Cyclic torsion testing will be utilized at temperatures below the melting point of the material to locate the $T_g$ of the material. Once complete the material properties will be used to compare all the loading levels to the base resin and to determine an optimal material composition with superior mechanical properties.
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 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, which is important in the food packing industry because the better the film can block out oxygen, the longer the food can stay fresh. The manufacturing cost is also cheaper compared to other commercial methods making this film a viable option in the future.
Nanofibers are usually defined as fibers that have a diameter below 1 micrometer. Such nanofibers gain advantages over the conventional big fibers, such as having higher surface area to volume ratio and being able to form a porous 3D structure. This nanofibrous 3D product can be utilized in filtration applications, such as water, air, oil and other types of filters for the fields of food, beverage, automobile and pharmacy. Other than aforementioned filtration applications, it can be also utilized in biomedical field such as tissue scaffold, artificial organ, and wound dressing. In this poster, we are introducing a novel method to manufacture nanofibers using a co-extrusion technology.
Abstract: The Causes of Eating Disorders and its Treatments: A Literature Review

Anorexia and bulimia nervosa are two examples of life-threatening eating disorders that should not be overlooked. Since these individuals will either deny their hunger, self-vomit, or use other maladaptive measures to keep their weight down, it is important to know where their motives came from. Although eating disorders are affecting many men and women, this literature review will discuss the prevalence of this behavior in young females, and explain why it is a rising health issue for them. This research explores three aspects that can contribute to disordered eating, such as the media, athletics, and stress. The media distorts the minds of young women. It sends out deceiving messages implying that success, happiness and approval are obtained by being thin. Female athletes are vulnerable because they often believe that their weight determines their success. Stress can cause one to neglect their essential needs and it also can be used as a coping mechanism in eating disordered behavior. In addition to these causes, the literature examines possible treatments for those struggling in hope for recovery. Overall, eating disorders are worth studying more aggressively so they can be detected and treated early.
**Presentation ID**: 10605  ** PUlD: 10605  ** Page 449 of 497

**Presentation ID**

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**Title**

* Dance Technique Immersion through a Paul Taylor Intensive

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**Author Affiliation**

Case Western Reserve University

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**Elevator Speech**

Creative research allows artists to refine their work and learn new tools in which to create new works, which can then be shared with the public.

**Key Words**

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**Abstract**

This is the presentation of a solo dance work choreographed in the style of Paul Taylor. I created this solo as a culmination of my creative research this summer in which I attended Paul Taylor’s American Modern Dance (PTAMD) intensive held at the Peabody Institute at Johns Hopkins University in Baltimore, Maryland, as a SOURCE 2015 Summer Research Scholar. My objectives in attending this program was to explore the Taylor technique and repertory in order to expand my movement vocabulary to make me a more versatile dancer and to study the choreography of a great modern dance choreographer to help inform my own choreographic endeavors.
Intravenous drug use is associated with alloimmunization in pregnancy

Anecdotal evidence has suggested an association of intravenous drug abuse with alloimmunization, however published data are limited to case reports. A retrospective cohort study was performed using data from a single-center blood bank and perinatal database from 2008-2014. Blood bank data was used to identify women with alloimmunization, defined as a positive antibody screen in pregnancy not due to a naturally occurring antibody or Rh immunoglobulin administration. For multiparous women, only the most recent affected pregnancy was included. The rates of alloimmunization among women with a history of intravenous drug abuse and general obstetric population were calculated and compared using chi-squared. Alloimmunization was more common in women with a history of intravenous drug abuse (11 of 305, 3.6%) compared to women without a history of intravenous drug abuse (288 of 16,022, 1.8%, RR 2.00, 95% CI 1.11-3.62). Needle sharing was present in 7 and suspected in 4 women with an intravenous drug abuse history. The distribution of alloantibodies was different between intravenous drug abuse- and non-intravenous drug abuse-associated alloimmunization with Rh group alloantibodies and Rh negative status more common in women with a history of intravenous drug abuse. The rate of multiple alloantibodies was not different between intravenous drug abuse and non-intravenous drug abuse alloimmunization. Maternal history of IVDU is associated with an increased risk for AI, which is significant given the current US opioid epidemic. Approximately 1 in 30 intravenous drug abuse women may be diagnosed with an alloantibody in pregnancy. Needle sharing represents a possible mechanism for intravenous drug abuse-associated alloimmunization, however limited obstetric care, failure to obtain Rh immunoglobulin, or failure to identify early pregnancy loss cannot be excluded.
The Prey Avoidance: A Robotic Implementation of Cockroach Survival Behavior

The diversity of animal behavior and adaptation provides a myriad of inspiration for the development of mobile robots. Our team has developed a cockroach robot modeled on the predator-prey interactions between praying mantises and cockroaches. Praying mantises prey on various cockroaches. Interactions between the deathhead cockroach, Blaberus discoidalis (B.d.), and the local praying mantis Tenodera sinensis have been extensively studied, and robot analogs have been made to demonstrate the behavior of each species and their predator-prey interactions. The purpose of this research is to study the faster and more active Periplaneta americana (P.a.) and use the results to improve the capabilities of the cockroach robot. Natural interactions between the cockroach and praying mantis were captured using high speed video. Analysis of the video was completed in C-Trax or WinAnalyze motion analysis software. The results of the P.a. behavioral studies are used to modify the RAMBLER algorithm (which simulates B.d. behavior). Revisited abilities from previous B.d. robots include the ability to detect and avoid walls and an analogous cerci response (detection of motion by sensory organs via wind created by the predator). This year, a newly engineered P.a. robot features abilities based on P.a. behavior studies, including a revised escape response and selectable light modes to demonstrate behavior under different ambient light conditions.

The strike of the mantis robot’s arm can result in the cockroach robot being “captured” or escaping. Capacitive copper plates on the cockroach communicate where the strike landed. Two of the plates initiate a directional escape response, and the third indicates a successful mantis strike. By including these capabilities and behaviors, the cockroach robot is able to interact with the mantis robot to demonstrate predator-prey interactions of mantises and cockroaches.
Cohesion and adhesion, which describe how strongly particles will cling to like, or unlike materials, are still poorly understood in asteroid regolith. A greater knowledge of these forces would not only better inform us of the story of asteroid formation, but also aid engineers seeking to design spacecraft that are immune to potentially damaging regolith. A significant obstacle in solving this problem is the scarcity of asteroidal material on Earth. However, there are still ways to study these materials. Meteorites, relatively unaltered chunks of space debris that have passed through Earth’s atmosphere can be used as an analogue for asteroids. Using a torsion balance in an ultrahigh vacuum chamber at NASA's Glenn Research Center, it is possible to quantify the strength of cohesion and adhesion of meteorite samples. In order to accomplish this, a full characterization of the mineralogy of the samples was made. First, the meteorites were imaged using a variety of microscopy techniques (Optical, PLM, and SEM). Next, a variety of characterization techniques were attempted (Raman spectroscopy, EDS, and Elemental Mapping) to determine the relative abundances of minerals in the different meteorites. As the focus of this project was the CM2 carbonaceous chondrite, this specimen received the greatest emphasis. From this, it was found that the primary mineral phases were olivines, pyroxenes, and altered phyllosilicates. In addition to these, minor amounts of sulfates, carbonates, oxides, iron-nickel metals and sulfides were found to be present. With this information, the broader cohesion and adhesion quantification project can proceed with an understanding of the diversity of material properties likely to be encountered.
This project focuses on the biological research and robotic implementation of a praying mantis predator-prey interaction. An algorithm was written and implemented to control a mantis robot such that it would mimic the behavior found in biological experiments.

**Key Words**  
Robotics  
Predator/prey  
Praying Mantis

**Abstract**

This project focuses on the biological research and robotic implementation of a praying mantis, *Tenodera sinensis*, interacting with a prey-like stimulus. One of the main points of interest was how the distance and angle of a cockroach prey influenced the praying mantis' behavior. This was tested through an artificial stimulus on a computer screen, which mimicked the shape of a cockroach, and swept the front of the praying mantis' visual field at 2 body lengths per a second at distances between 3-30 cm at 3 cm increments. The praying mantis' behavioral response to the stimuli included tracking (moving its head to follow the stimuli), pursuit (taking steps towards the stimuli), and striking (hitting the stimuli with its front legs). These responses fell off around 15 cm suggesting the praying mantis could not see a 2D stimulus after this point. Praying mantis vision likely extends farther when a 3D stimulus is presented instead of a 2D. This will be tested using a gantry with a motorized magnet to drag a pinned cockroach around an arena in a set path mimicking that of the artificial stimuli on the computer screen.

An algorithm was written concurrently to control the mantis robot such that it would mimic the behavior found in these experiments. The algorithm uses the probability data collected from the conducted experiments. This algorithm was then implemented on a simplistic robot, with a limited range of motion that mirrors the praying mantis' ability to strike and capture its prey. Specifically, the mantis robot detects the motion of a cockroach robot, and reacts differently depending upon the distance and angle of the cockroach robot. We based our model of the insect interaction on three main observed states: tracking, pursuing, and striking. Together the cockroach and mantis robot are capable of interacting in a simplistic environment while showing a quasi-realistic predator-prey relationship similar to that shown in the experimental results.
Facial expression has been examined by researchers dating back to Darwin as an external indicator of a primate’s emotional or physiological state. Human expressions were analyzed using a Facial Action Coding System (FACS), which was modified in later studies to examine other primate’s facial expressions. Gorillas were only analyzed to a limited extent. Despite these deficits in research, Gorillas are suitable organisms for facial analysis because they live in highly structured social environments and exhibit a variety of expressions. Thus, our project focused on analysis of gorilla facial expression. In our initial analysis, still images of silverback gorillas were obtained from several sources through Dr. Kristen Lucas of the Cleveland Metropark Zoo. These were analyzed to establish a baseline facial structure of static expression. To avoid anthropomorphization of the expressions, the associated behaviors were unknown at the time of the analysis. Once the baseline data was established, we filmed facial behavior of silverback gorillas at the Cleveland, Columbus and D.C. Zoos, using high speed cameras. We then compared facial parameters to the baseline. All data was digitized in WinAnalyze motion analysis software. Preliminary analysis of the data suggests that the shape of the mouth and the brow are useful in distinguishing facial expressions. Mouth shape was determined by the distance between the lips and the angles of various parts of the lips. Brow shape was determined by the angle of the brow and the distance between the brow and the eye. Static data show that mouth shape is the most prominent indicator of emotions. The brows show less variation across the images but were more symmetrical than the mouth. Overall, brow-to-eye distance suggests more variation than the brow angle and could reflect emotion. We predict that further analysis of non-static behavior and rate of change of facial parameters can differentiate aggressive and nonaggressive behaviors.
Effects of Math Anxiety on Working Memory

There is extensive literature that explains the effects of math anxiety on math performance. It is still relatively unclear how the anxiety affects the individual's ability to perform math tasks. However, there is reason to suspect that working memory may help to bridge the gap.

There is extensive literature that explains the effects of math anxiety on math performance. It is still relatively unclear how the anxiety affects the individual's ability to perform math tasks. However, there is reason to suspect that working memory may help to bridge the gap. It is widely accepted that working memory plays a crucial role in math related tasks, but it is unclear how math anxiety affects working memory. We expect to find that high math anxious individuals perform poorly compared to low math anxious individuals on working memory tasks, due to the influence of anxiety.
Guardian of the Genome; p53 as a target for anticancer drug discovery

Tumor suppressor protein p53 plays an active role in the prevention of cancer and maintenance of healthy cells in the body. It has the ability to induce cell cycle arrest, apoptosis, cell senescence, DNA repair, and changes in metabolism. When not bound to the Mdm2 inhibitory factor, p53 is able to mediate permanent cell cycle arrest and apoptosis through various downstream mechanisms and protein transcription. Mdm2 is an E3 ubiquitin ligase that tags p53 for degradation when its function is not required in healthy cells. One of the main functions of p53 is to upregulate the expression of the p21 gene as a response to DNA damage. p21 protein acts as an inhibitory factor when complexed with cyclin dependent kinase cdk2, preventing a damaged cell from entering the next stage of the cell cycle.

Predispositions to cancer can be inherited if only one functional copy of the p53 gene is passed down from both parents. These individuals usually develop several independent tumors in early adulthood. p53 is inactivated or mutated in at least half of all cancer cells, making it the most frequently altered gene in human cancers. Common mutations in p53 include base pair substitutions that disrupt the natural folding conformation of the protein, leading to a loss of wild type function.

The aim of this research is to study the role of p53 in cancer and the negative effects mutations in the p53 protein can have on a cell. Most clinical drugs targeting p53 are aimed at restoring its natural conformation in order to induce cell apoptosis. APR-246 is the only clinical drug currently being used in human trials. Other drugs targeting p53 are also in the development pipeline, and their specific mechanisms of action will be compared and contrasted to APR-246.
How to Stop Yourself from Bleeding to Death

Our bodies are sometimes incapable of stopping systemic bleeding after profound physical trauma. Synthetic platelets can augment our natural clotting to solve this problem. Modulus of platelets is thought to play a significant role during clotting; therefore, biomimetic artificial platelets should be synthesized so that they match the modulus of natural platelets. We are developing a procedure using an atomic force microscope (AFM), a high-speed digitizer, and custom MATLAB code to obtain platelet modulus. The AFM provides voltages that are proportional to strain gauge loads. In our code, we extract the relevant portion of the voltage signal and convert it to loads. Using a combination of the voltages and a set of instrument parameters, we then compute sample deformation. Our next step will be to use a combined Hertz-Sneddon model to obtain modulus from the load deformation curves.
The Development of Maternal Identity in the NICU: An Analysis of Programs and Initiatives Designed to Promote Increased Maternal Engagement

Although the development of an early bond between the mother and her child has been described as critical for infantile development, mothers' limited interactions with their infants in Neonatal Intensive Care Units (NICU) have become a concern. Drawing from existing research and looking at the expressed concerns and experiences of mothers in the NICU, I will evaluate care practices and programs in these facilities targeted towards promoting maternal engagement and easing the transition to motherhood. Hospitals and birthing centers are becoming aware of this need and are designing and implementing certain measures to help close this gap. By also analyzing initiatives in European and Australian NICUs, I will provide suggestions for the integration of effective practices from these facilities known for their advanced preemie care practices.
Cancer Drug Response Networks (CADREs) provide an integrative way to classify drug response. The networks were built utilizing large-scale, publicly available data on baseline copy number, gene expression, and drug sensitivity data for various cancer cell lines. The nodes of the networks represent drugs and the edges are common features (dysregulated genes or pathways) affiliated with cell lines sensitive to those drugs. The edges are weighted based on the number of shared differentially expressed genes, copy number variations, and dysregulated pathways between two drugs. It was observed that drug pairs that exhibit synergism in previously conducted clinical trials do not cluster together in the networks. However, completely unconnected drugs in the network do not exhibit increased synergism in clinical trials. Based on these observations, we have been able to identify potential combinations of drugs for breast cancer treatment. By changing how we classify cell line sensitivity from a hard cut off to a percentile cut off and by adding discordant edges to our networks that represent dysregulated genes or pathways that are opposite in dysregulation direction between drugs, we have been able to improve the specificity of our drug repositioning predictions.
Abstract

The South Infirmary Victoria University Hospital is a surgical hospital in Cork, Ireland. The hospital underwent a transformation program from 2007-2010 and emerged with eight surgical specialties for pediatric and adult patients. One need identified by hospital staff and parents of pediatric patients was better pain management for pediatric patients, especially on weekends. The hospital functions at full-staff during the week and partial staff on weekends, so many times pain goes undermanaged in pediatric patients on weekends because there are few physicians to write new analgesia orders. Undermanaged pain is a bigger problem in pediatric patients than in adult patients because pediatric patients are too young to use patient controlled analgesia (PCA). In order to implement nurse-controlled analgesia (NCA), parents need education about the new concept, so development of a parent information leaflet was needed.

The goal of this project was to create an evidence-based education leaflet for parents with children undergoing surgery. Pertinent literature was retrieved from CINAHL and PubMed databases and reviewed. The National Adult Literacy Agency (NALA) guidelines for Ireland were followed. The Flesch readability score was used to make the information leaflet readable and understandable to the general public. Several drafts of the leaflet were reviewed by parents, nurses, and physicians. Feedback was incorporated into subsequent revisions. The final version was reviewed also by these groups and feedback was very positive. This leaflet will be used as an educational resource for parents whose children are receiving NCA. The hospital will pilot NCA in 2016.
The synthesis of GABA, the main inhibitory neurotransmitter in mammalian species is tightly controlled, and plays an important role in several neurological conditions such as epilepsy. In order to better understand how GABAergic neurons are regulated, this project analyzed the expression patterns of glutamic acid decarboxylase (GAD) which catalyzes the synthesis of GABA in adult aging brains in Drosophila. While previous studies of GAD in Drosophila investigated global expression levels of entire brains, they lack the resolution to see regional expression (FlyBase). Additionally, these studies fail to look at whether changes in expression are due to cell death, or new expression. To address these issues, we employ a technique known as GTRACE (Gal-4 Technique for Real time Clonal Expression) which utilizes fluorescence to track the synthesis of GAD over time. With this technique, we can determine when GAD is activated in adult and senescing cells regionally at the single cell level. Results from our study reveal that both adult male and female Drosophila experience global cell death after 10 days, but retain relatively steady levels of new expression over the course of 30 days. Our results also suggest that GAD activation and repression patterns are distinct between males and females, and occur as a wave from outermost regions of the brain towards deeper regions.
Oral health is essential to general health and well-being; thus, reducing and eliminating disparities in dental care will accordingly improve overall global health. The purpose of this literature review is to understand the impact of socioeconomic status and sociodemographic factors on dental health behavior, by investigating how variables such as income, education, family, and geographic location influence dental self-care, which contributes to overall oral health. Numerous studies have shown that there is an association between socioeconomic status and health: in most cases, an individual with a higher socioeconomic status will have better health. The literature in this area generally defines socioeconomic status across three broad measures: education, occupation, and income; however, such conventional measures are rather simplistic and merely correlate social status with health status, and do little to explain how status influences health behavior. Therefore, I will also consider sociodemographic factors, which are the intricate pathways by which socioeconomic status affect lifestyle and behavior. Understanding how all these variables mediate oral health behavior will better predict and identify those with high levels of need for dental treatment and facilitate ease of access to dental care.
The chemistry of nerve agents, with special attention paid to one of the most widely used chemical weapons, sarin, is reviewed. It is important to note that this chemical has high vaporization properties, so it can be used as a gas and liquid at the same time. The uses of the compound in modern warfare, including in the ongoing Syrian civil war, has been documented since its synthesis in the 1930s. There are several steric factors, which play an important role in making sarin so potent and dangerous to those exposed to it. Sarin’s ability to covalently bond to acetylcholinesterase’s (AChE) active site and inhibit the electrostatic interactions between acetylcholine (ACh) and AChE, is sarin’s most powerful property. ACh is a neurotransmitter used to signal muscle contraction in the body and AChE is an enzyme tasked with hydrolyzing ACh once it has completed its signal reaction. Therefore as sarin blocks the breakdown of ACh, the body’s muscles are continually signaled to contract, ultimately leading to death due to asphyxiation. Also, because of sarin’s chirality, it has two enantiomers, however one isomer has a greater affinity to bond with AChE. Nonetheless, sarin is lethal and when used as a chemical weapon, even in cases of timely treatment, its victims have a low chance of survival.
# Race and Economics: The Anti-Chinese Riots of 1918 in Jamaica

**Abstract**

This project analyzes the anti-Chinese riots of 1918 in Jamaica in order to better understand the root causes of the “Chinese problem”. The research draws upon letters to the editor in the local newspaper, testimonies from the Chinese community in Ray Chen’s *The Shopkeepers*, and several secondary sources in order to assess the riots in the context of the time and racial hierarchy of the island. The anti-Chinese riots of 1918 in Jamaica were the first of three to occur in the island. When a Chinese shopkeeper allegedly staged an ambush on a Black officer to protect his business, Afro-Jamaicans were outraged and began the longest of the three riots. These riots had a negative impact on Chinese businesses and their relationship with other ethnic groups in Jamaica. Scholars have argued that the root cause of the 1918 riots was racism. However, this explanation does not provide a complete analysis of the issues that led to sustained discrimination and violence towards both local-born and immigrant Chinese. By looking at the history of Chinese immigration and assimilation in Jamaica, this project highlights both economic and social roots of the riots that were linked to the socioeconomic hierarchy and power dynamics present in the island during the twentieth century.

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**Elevator Speech**

This research is necessary in order to better understand the current position that Jamaican Chinese have in the island and how the economic and social relationship among ethnic groups can be improved.

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**Key Words**

- Jamaica
- History
- Riots
- Sinophobia

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**Group:** Full Abstract Report

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**Published?**

- True

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**Author Status**

- Undergraduate student

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**Author Affiliation**

- Case Western Reserve University

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**Presentation Type**

- Poster
This project intends to create a low-cost and precise apparatus which can measure the net charge present in a dielectric sample so that we may obtain precise data on the changes in the net charge on the sample in response to changes in the electric potential in the environment. The measurements will be made by moving a dielectric sample within a Faraday shield and between two Faraday cup stacked vertically. By measuring the net charge of the dielectric sample in ground potential equilibrium and monitoring the temperature and pressure of the surrounding area we should be able to minimize the uncertainty of the original apparatus. This will also allow us to evaluate other effects, such as the influence of triboelectricity and other sources of error. In general, this project aims to evaluate and test the effectiveness of the apparatus, to eliminate error in the apparatus, and to examine the physical significance of small changes in net charge on a dielectric, using our own low-cost and precise apparatus based on Thomas F. Peterson, Jr’s patent.
Effect of geometric location and background on Hounsfield number in CBCT imaging

Objective:
This pilot study tests the variation in average Hounsfield number (HU), of three CBCT calibration disc, based on the location and background of the discs.

Methods:
Three Hydroxyapatite discs with known uniform mass densities were secured on top of a hemi-mandible sample, extracted from a human cadaver that had 2nd premolar and 1st molar missing. Discs were secured at location A (between 1st and 2nd molar on buccal site); location B (between 1st molar and 2nd premolar on buccal); location C (between 1st premolar and canine on buccal). The sample was imaged using a micro-CT scanner at 80Kvp and 500 mA. After imaging, the disc was relocated to location B and subsequently location C. The other 2 discs followed the same sequences. Reconstructed 3D images were analyzed using Invivo5 software. The variation in average HU for a single disc based on its location on top of the bone sample was measured. Furthermore, we used a ROI (4mmx4mm) to analyze the variation in average HU within a single plane, and between three different planes of the disc. The procedure was replicated and statistical analysis was performed to exam any differences.

Results:
A maximum of 19.9% difference was measured for the variation of average HU of a disc based on the location on top of the hemi-mandible. A maximum of 3.7% difference was noted within a single plane; however, a maximum of 22.3% difference existed when analyzing the average HU between multiple planes of a single disc. Furthermore, the average HU values for all three discs were at least 9.5% higher when placed on location B.

Conclusion:
Given the results of this study, we believe the calibration phantom must be as close as possible to the ROI to appropriately calibrate HU values for bone quality evaluation.
Previous experiments revealed distinct differences in the locomotion patterns of Drosophila sibling species D. melanogaster, D. simulans, and D. sechellia; D. sechellia has a significantly slower speed of crawling and contraction waves than D. simulans and D. melanogaster. These species-specific locomotion patterns were found to be associated to divergent X-linked genes. We selected CG32647, the top candidate gene from a previous genome-wide comparison, for further investigation. We verified that CG32647 is highly expressed in the larval carcass, which contains the muscles and peripheral nervous system. Additionally, protein-protein interaction studies indicated that the protein encoded by CG32647 associates with Bruchpilot, which is involved in synaptic transmission, neuromuscular junction development, and neurotransmitter secretion. One possible explanation for the phenotypic differences between species could be alterations in sensory neurons, which provide sensory feedback to neurons controlling movements (central pattern generators). Prolonged inhibition of the multiple dendritic sensory neurons has been shown to stop larval locomotion. We hypothesized that CG32647 would be expressed in the multiple dendritic sensory neurons, and therefore would play an important role in larval locomotion patterns. In order to identify the sites of CG32647 expression in the larvae, the Gal4-UAS system and in situ hybridization methods were used. CG32647 was found to be expressed in several types of multiple dendritic neurons in the larvae. In future experiments, the function of CG32647 will be determined by studying the locomotion patterns of D. melanogaster larvae that do not have expression of the gene.
## Abstract

In this literature review, oral health and its relation to society will be explored. By reviewing the literature, the presenter hopes to gain an understanding of the factors that affect oral health and the programs that serve to improve this aspect of health. This review will first acknowledge society’s view on the relations between oral and general health before moving on to establish the significance of oral health and its consequences. Then after examining the factors that impact oral health, the disparities in dental care will be identified. The presenter will then assess society’s responses to the mouth–body connection through the various interventions that aim to better oral health.
Introduction: Parkinson’s disease (PD) is a neurodegenerative disease that is characterized by the loss of dopaminergic neurons and accumulation of aggregated protein alpha-synuclein (AS) in the midbrain. Recent studies have suggested that AS aggregation may propagate in vivo through prion-like transmission. To evaluate the role of amyloid proteins made by microbiota we utilized the nematode C. elegans as a model organism that feeds on bacteria. By exposing C. elegans to bacteria expressing endogenous amyloid protein curli, we tested whether exposure to bacterial amyloid protein affects the aggregation of AS.

Methods: Using C. elegans line with AS fused with the yellow fluorescent protein, aggregation of AS protein is observed via fluorescence microscopy. The worms are grown on E.coli that produces curli(wild type) or E. coli that does not(mutant). Age-synchronized adult worms are observed under the fluorescent microscope for four days. AS aggregation are scored by using a 5-point scale. To observe the physiological effects of aggregation, a swim test was performed. The worms are placed in a solution and video recorded for 20 seconds. The worm bends are then tracked through the software Worm Lab. Results and Discussion:

It was found that aggregation typically occurs between day 2 and day 4. On day 2, animals with mutant curli had more aggregation with a score of 2.27±0.79, but by day 4, animals with WT curli had greatly increased aggregation with a score of 3.8±0.76. The mobility of the worms decreased with the worms bending less by day 4. On day 2, WT had 20.8±4.87 bends and mutant had 23±8.48 bends. By day 4, WT had 12.8±6.99 bends and mutant had 12.3±3.59 bends. More trials will be run to confirm the trend. In summary, these initial experiments showed that AS aggregation increased while mobility decreased when exposed to E.coli expressing bacterial amyloid protein curli. Therefore, the role of microbiota in AS aggregation in PD deserves further investigation.
Over the past decade there has been a significant increase in the attention and concern placed on mental health among college students. In this literature review, I look into the prevalence, stigma and resources available for college students in regards to mental health. I address the most commonly reported mental illnesses, comparing the differences of mental health issues over the years and how such changes effect the overall well being and performance in a college setting. Likewise, this paper investigates the presence of stigma and the differences in how mental health issues are viewed among a college population, as well as the relationship between its effects on acceptance and seeking treatment. Lastly, a further review of mental health resources offered at universities is covered to recognize the measures being taken to provide assistance and care to students. By better understanding the prevalence and ways in which college students view mental health, we could help advance the approach in reaching such a venerable population and work to positively enhance their understanding, views of mental health and willingness to seek needed treatment.
A chiral object cannot be superimposed onto its mirror image through rotation or translation. In Nature we find many examples of chiral objects, including DNA, the human hand, and many organic molecules necessary for life. There is a plethora of phenomena and applications related to chirality, including the water wheel from antiquity, rotation of optical polarization, pharmaceuticals, and electrical polarizations in the smectic-C* phase of liquid crystals. Pendery et al. [EPL, 96, 26001 (2011)] succeeded in inducing surface --- or quasi-two-dimensional --- chirality on a flat substrate at the nanoscale (200 nm) by scribing a chiral step pattern on polymer-coated slides. This project aims to reduce the scale of the uniform step pattern to approximately 20 nm by scribing the pattern with the stylus of an atomic force microscope. We will measure the resulting chiral induction strength using the liquid crystal electroclinic effect in the nematic phase as a metric as we vary the overall scale of the pattern and the ratio of the “horizontal” and “riser” parts of the step.
The purpose of this project is to determine the best candidate for a biomedical engineering polymer as an implantable plastic. Current medical plastics and devices oftentimes fail due to stress cracking, the effects of bodily fluids, harsh environments, medical sterilization techniques, or contamination. Ideal properties of a medical plastic implant include chemical resistance, ability to withstand sterilization and autoclaving, and biocompatibility. Therefore, five polymers were selected for testing in relation to these properties in addition to thermal capacity. Analyses were run using differential scanning calorimetry in order to determine where thermal transitions occurred for each polymer and to evaluate which could function as a potential medical plastic. Experimentation verified that these polymers were viable options for medicine and withstood thermal stress. Based on the suitability of the polymers to medicine and medical devices, this research could also be extended to greater applications, such as automobiles and aviation.
Recent scientific evidence has shown small internal molecules called S-nitrosothiols (SNOs) present in the human airway. They have pertinence to cystic fibrosis lung disease. These novel compounds are synthesized via the reaction of a cysteine residue with reactive nitrogen species, nitric oxide (NO) and are less abundant in CF airways relative to normal ones. Several research groups have reported that different SNOs increase the maturation along with the function of CFTR (cystic fibrosis transmembrane conductance regulator), at the cell membrane in human airway epithelial cells. Our preliminary data suggests that the molecular co-chaperone, carboxy terminus Hsc70 interacting protein (CHIP) is a critical target of SNOs. We found that SNOs increase CHIP S-nitrosylation, ubiquitination and degradation. Its S-nitrosylation results in CFTR maturation and all surface expression. CHIP S-nitrosylation by SNOs inhibited its association with CFTR in the endoplasmic reticulum. This effect was necessary and sufficient to mediate GSNO-induced cell surface expression of CFTR. In addition, CHIP knockdown using siRNA duplexes specific for CHIP recapitulated the effect of SNOs on CFTR maturation and expression. In this project we hope to evaluate the novel mechanisms by which GSNO reductase and its inhibitors target CFTR maturation and function at the cell membrane.
Framing by the media plays a huge role in how presidential candidates are perceived by the general public which influences whether a citizen will vote for a certain candidate. Because candidates are only human, they have the tendency to make mistakes such as forgetting part of a proposed policy or the exact number of a figure used in an argument. How much of an effect does a candidate’s memory or lack there-of effect his perceived competence in the eyes of the general public? The hypothesis was that the mistakes in terms of memory in debates and other speaking engagements will not negatively impact the public's perception of the candidate's competency due to the established information that memory is not very reliable. This hypothesis was tested by finding some instances of presidential candidates forgetting portions of their proposed policies in the midst of a debate response and how their poll numbers changed in the time period immediately following the gaffes such as Rick Perry forgetting what departments he wanted to abolish in a November debate for the 2012 Republican nomination. The data supported the hypothesis and showed that there was not a large drop in poll numbers after the gaffe occurred and a drop in the polls could not be correlated with a single event.
Abstract

Single-sided Magnetic Resonance Imaging (MRI) has enabled applications of MRI technology which are impractical or impossible with traditional MRI scanners due to their size and cost. Prior research has shown that single-sided MRI is an effective tool for generating three-dimensional images and for taking velocity measurements along a two-dimensional plane. If single-sided MRI scanners can be proven as effective for measuring the velocity of a flowing fluid along three dimensions, new applications for the technology could be developed for the field of medical diagnostics, where reduced invasiveness and improved precision would result in fewer complications during subsequent treatments. The purpose of this project is to design and optimize a method to collect velocity measurements of fluid flow along three axes using a single-sided MRI scanner. The scanner is modified to include two gradient coils capable of generating magnetic fields with a linear gradient. Within a vessel containing a flowing fluid, the designed method can take velocity measurements at several voxels, the locations of which are differentiated by the strength and direction of its magnetic field, which varies approximately linearly along all three axes.
Food insecurity and food deserts are two social constructions that are highly correlated. Food insecurity is a state of limited or unreliable access to an adequate amount of healthy food. It is the uncertainty some individuals face when thinking about whether or not they will be able to eat at least one snack, let alone meal, throughout the day and night. A food desert is a geographical region in which there is little or no access to fresh produce—fruits, vegetables and other wholesome foods. A direct outcome of this is food insecurity. Not all food insecure population areas are identified as food deserts; however, all food desert areas are prone to experiencing food insecurity. Food is fundamental to our survival as human beings. Along with water, it is essential to the continual successful functioning of physical human bodies. Therefore, not consuming an adequate quantity and quality of food will inevitably result in nothing but harm. Nutrition is especially important for children, since a lot of key physical, cognitive and social development occurs during the early years. Any lapse in this development will have serious lifelong consequences for children. However, this is not to say that other age groups remain unaffected; an insufficient diet is detrimental to the health and well-being of all individuals. Therefore, it is important to solidify the correlation of food insecurity and food desert status, as well as determine whether there is causation between the two variables. This literature review aims to explore the impact of food deserts on food insecurity in the United States.
As a sustainable paving practice, there has been increasing interest in the use of reclaimed asphalt pavement (RAP) during pavement reconstruction and maintenance. The behaviors of RAP have been studied in many lab and field experimental programs, which aim to characterize the effect of RAP on performance of asphalt pavement. However, there are debates on the maximum amount of RAP allowable for paving without compromising its performance. Research on the mixture containing varied proportions of RAP is therefore crucial to optimize the application of RAP. Asphaltene, the main chemical component in asphalt binder, is mostly reactive to oxygen. In this study, aged asphaltenes in RAP were created based on chemical changes. The model system with low potential energy was created by employing Monte Carlo simulation. Molecular dynamics (MD) simulation was carried out to evaluate the thermodynamic properties of aged asphaltenes, compared with original asphaltenes. The analysis was conducted at -15, 5, 25, 45, and 65 °C. This preliminary study paved the way for further study on the behaviors of the blended asphalt binder with recycled asphalt binder.
Noise can irreversibly damage sensory receptors of the inner ear, hair cells, and lead to permanent hearing loss. During acoustic overexposure, substantial amounts of Ca2+ ions enter hair cells through mechanotransduction channels. Elevated Ca2+ levels may trigger an increase in reactive oxygen species (ROS) production in hair cells—the key characteristic of noise-induced hearing loss. The goal of this project is to test whether mitochondrial Ca2+ uptake is necessary for increases in ROS generation in mechanosensory hair cells. In vivo and in vitro studies that will use an MCU-/- (mitochondrial Ca2+ uniporter) in zebrafish models. The central hypothesis is that acoustic overexposure leads to mitochondrial Ca2+ overload in outer hair cells.

This project studies the affects of noise overexposure to the mechanotransduction channels in the ear. The goal of this study is understanding how acoustic overexposure impairs Ca2+ balance and disrupts redox homeostasis in auditory hair cells. The hypothesis is acoustic overexposure leads to mitochondrial Ca2+ overload in outer hair cells. The zebrafish model with MCU was fused with fluorescent citrine: mcuct149aGt/ct149aGt. This demonstrated that hair cells in this transgenic fish are functional. In the future we plan on breeding the mcuct149aGt model with another transgenic zebrafish that express Cre in hair cells only.
Recently, members of the Case Western Reserve University Farm Food Program have begun producing various varieties of oyster mushroom inside the old root cellar of the Squire Valleevue Farm. Generally, oyster mushrooms require humid climates with low CO2 levels (<800ppm) to grow and thrive successfully. Additionally, different growing phases (colonizing vs. fruiting) require different environmental temperatures. Therefore, to allow for year round mushroom production, the Farm Food staff have retrofitted the cellar with multiple new energy subsystems including heat, light, water, ventilation, and data monitoring and acquisition. Most of these systems rely on timers to eliminate the need for constant powering, but even then, some of these systems exhaust large amounts of energy when operating. Therefore, in hopes to reduce the need for large amounts of grid-fed, non-renewable energy for this new production area at the Case Farm, we have designed and implemented a wind turbine that will first power the lighting and data monitoring and acquisition subsystems within the cellar’s colonization room. For this application, we have designed a vertical axis wind turbine (VAWT) that should produce approximately 500 watts of power despite various location design restrictions including low average wind speeds (approximately 10mph) and a height limitation (no more than 15ft). Many of the components for our turbine have either been refurbished parts that we found in storage or stock components that have been machined to specification. Once the main turbine is completed, more work will be required to connect the power generated from the structure to the colonization room and also add an automatic breaking system to restrict any rotor motion during high wind gust weather.

Project Mentors: Christopher Bond, Squire Valleevue Farm, Dr. Ana Locci, Department of Biology
A chiral object cannot be superimposed onto its mirror image through rotation or translation. In Nature we find many examples of chiral objects, including DNA, the human hand, and many organic molecules necessary for life. There is a plethora of phenomena and applications related to chirality, including the water wheel from antiquity, rotation of optical polarization, pharmaceuticals, and electrical polarizations in the smectic-C*phase of liquid crystals. Pendery et. al. [EPL, 96, 26001 (2011)] succeeded in inducing surface --- or quasi-two-dimensional --- chirality on a flat substrate at the nanoscale (200 nm) by scribing a chiral step pattern on polymer-coated slides. This project aims to reduce the scale of the uniform step pattern to approximately 20 nm by scribing the pattern with the stylus of an atomic force microscope. We will measure the resulting chiral induction strength using the liquid crystal electroclinic effect in the nematic phase as a metric as we vary the overall scale of the pattern and the ratio of the “horizontal” and “riser” parts of the step.

his project aims to further our understanding of inducing chirality into a bulk material of achiral materials. In our case, the material of study is liquid crystals. Looking into the future, our work may result in the creation of small, inexpensive optical polarimeters and detectors of chiral particles.
An integrated approach to riverine recreational fishery assessment

Steelhead (Oncorhynchus mykiss) angling in Ohio is worth $14 million annually. The Grand River in Ohio supports a healthy stock of steelhead and represents a typical urbanized tributary of Lake Erie. Most public fishing access to the river is made available by the Lake County Metroparks and steelhead anglers are known for their preferences for specific locations and gear types, so I wanted to see if those preferences are correlated with good steelhead habitat as predicted by USGS habitat suitability indexes. I created a map of public access reaches on the Grand River and overlaid angler survey data and river parameters to geospatially organize the steelhead fishery. I found that anglers had strong preferences for access sites and microhabitats based on the gear they were using, but also that they fished on private lands. Furthermore, I found correlations between angler presence and two river parameters that predict good steelhead habitat (proportion of cobble, and median substrate particle size), but that most of the good steelhead habitat was not available in public reaches. This is why anglers trespass and create problems for land and fishery managers – private reaches of the river are much more challenging to restore if they become degraded by angler use. This information has the potential to improve management for the Grand River, but my method has a wider impact because of how easily it could be replicated for any riverine fishery for migratory species.
**Abstract**

Back by popular demand, the 2nd edition of the “Art of STEM" competition and exhibit at Kelvin Smith Library has once again brought together the Case community and high schools in NE Ohio to showcase amazing imagery resulted by integrating the Arts with STEM disciplines. Evaluated by a panel of judges, the competition awards monetary prizes and all entries were included in library print and online exhibits. This mini Art of STEM exhibit highlights the five winning images, three from the Case community and two from the high school students.
There have been numerous deadly diseases throughout history: SARS, H1N1 influenza, and more. Today’s disease of concern is Ebola virus. Currently, Ebola remains an outbreak in West Africa, not a pandemic, because it hasn’t spread globally. Studying Ebola virus is of the utmost importance to prevent a global disease spread.

The challenges presented by the Ebola virus disease are complex. There are specific social and cultural factors that have been connected to recent outbreaks of Ebola virus disease in West Africa. Traditional burial practices, virus infection during the preparation of “bushmeat” for human consumption, lack of trust in health authorities, discrimination from individuals that prevent acceptance into communities, and inadequacy in health systems have inhibited outbreak control efforts. The outbreaks also reveal widespread ignorance by the general public in regards to Ebola virus etiology, mode of transmission, and personal protective measures that can be taken. The relatively free flow of goods and people between regions and across international borders may have facilitated the spread of Ebola virus disease. The ultimate goal of this literature review is to provide an analysis of how Ebola virus disease can be studied via an anthropological perspective that examines the various sociocultural factors contributing to the outbreak of Ebola virus disease as well as the response of impacted populations.
Testis-determining factor SRY is located on the Y chromosome and is a key transcription factor in male developmental differentiation. Defects in this protein halt developmental genes and are manifested in the stability of the protein-DNA complex.

The DNA binding motif of SRY is the HMG box, that is conserved across its gene family SOX. In the HMG box, clinical mutations result in disorders, including XY sex reversal. 80% of the mutations in human SRY related to XY sex reversal are localized to the HMG box. At the start of the project, the goal was to use the N10 and Y72 positions that are conserved across SOX factors to understand the protein-DNA binding motifs that apply to the SOX superfamily.

The structure of SOX2 has shown Y72 makes contact to the DNA backbone, and uniquely, one water molecule is present in the spacing. The short distance between all three points may allow for the right internal conditions for a water mediated bond in a hydrophobic core. Without the correct conditions for this water mediated bond to form, this microenvironment fails to supply similar binding capabilities.

The spacing of the hydrophobic core where the water molecule resides is changed by clinical mutations Y72C and Y72F of human SRY. Unlike most mutations which happen spontaneously, the Y72F mutation was inherited and present in both the unaffected father and the offspring, whom experienced XY sex reversal. This suggests the change in the hydrophobic core was small enough to allow enough functionality to maintain the male developmental pathway in the father, but variable enough to disrupt SRY functionality in one generation.

Key developmental factors are expressed magnitudes higher in order to counter variability present among cells. However, if the failure of a single water molecule is enough for the male developmental pathway to be halted, this indicates a more ambiguous balance for sex determination in nature than expected.
Purpose
Depression in adolescence appears to be characterized by alterations in responses to emotional stimuli. The emotion context insensitivity (ECI) theory suggests that depressed individuals show less differentiated responses to positive or negative stimuli, relative to non-depressed individuals. The negative potentiation model suggests that depression is marked by heightened responses specifically to negative stimuli. The current study examined emotional responsivity in early adolescence, in relation to maternal depression, using EEG techniques. Analyses focused on the P300 segment of event-related potentials (ERPs) of electroencephalography (EEG) recordings. The current study investigated adolescent ERP responses to positive and negative emotional images and the potential moderating factor of mother depression.

Methods
40 sets of mothers and their daughters were recruited from the greater Cleveland area. Following interviews about emotional distress, daughters completed an emotional go/no-go task while brain responses were recorded through EEG. Four trials of the cognitive task occurred with each trial consisting of a different, randomized expression as the target emotion.

Results
Daughters whose mothers had higher levels of depressive symptomatology showed stronger P300 responses towards sad and angry stimuli, but not towards neutral and happy stimuli, indicating enhanced attentional processing specifically for negative affective stimuli. Daughters whose mothers were lower in depressive symptomatology showed a preference for happy faces as indicated by stronger P300 responses towards this type of stimuli over other emotions.

Discussion
Youth with depressed mothers may show an increased bias towards angry and sad, or negative stimuli. Maternal depression may be a significant predictor of future emotion regulation and cognitive functioning issues for their daughters.
Hydrostatic Pressure on Cartilage Formation in High-Density Human Mesenchymal Stem Cell Constructs with TGF-B1 Loaded Microspheres

Human cartilage has limited self repair capabilities. Tissue engineering is an attractive source for producing new cartilage tissue to replace defects. This study looks at some conditions for producing new cartilage from adult bone marrow stem cells.

Key Words
Constitutent
Cartilage
Microsphere
TGF (Transforming growth factor)
Stem Cell
Hydrostatic Pressure

Abstract
This study focused on the effects of hydrostatic pressure on human mesenchymal stem cell (hMSC) constructs. hMSCs can differentiate and form articular cartilage tissue which serves as a load bearing tissue in the body. In this study, cells isolated from human bone marrow in one donor were used to produce high cell density constructs. Some constructs were incorporated with gelatin microspheres containing transforming growth factor beta -1 (TGF -1). Constructs were loaded into steel cassettes and then placed into gas permeable bags filled with media. Some groups were stimulated with hydrostatic pressure after one week of culture while others were stimulated after two weeks. At the 21 day time point, constructs were harvested and analyzed for glycosaminoglycan (GAG) content as a marker for chondrogenesis and DNA content. Importantly, hydrostatic pressure increased GAG content normalized to DNA in groups without TGFB -1 loaded microspheres but had minimal effect on groups with microspheres. However, groups incorporated with microspheres showed higher GAG content in all cases. Although the combined effects of hydrostatic pressure and TGFB -1 loaded microspheres have yet to be elucidated, they may both be useful for cartilage engineering prospects.
Nanotechnology has true potential to promote cancer treatment and prevention. However, a fundamental basis for understanding how to treat cancers has not been established, and while various research has indicated a level of success in cancer treatment, reasons as to how this success is manifesting is not truly known. Given prior research analysis, a novel approach to treating cancers has been proposed.

As cancer becomes progressively worse, metastasis becomes a more prevalent issue. Known as intravasation, cancer cells pass through the basal membrane of its defined region to invade the blood or lymphatic vessel, allowing for travel to other locations in the body. Whilst in the bloodstream, disease-causing agents are expected to have low survival rates due to increased concentration of nutrients and immune cells circulating throughout the body. However, cancer cells avoid immune surveillance while in the bloodstream or in lymphatic vessels, due to the notion of epithelial-to-mesenchymal transition. This is a process by which epithelial cells lose their cell polarity and cell-cell adhesion, and gain migratory and invasive properties to become mesenchymal stem cells - multipotent stromal cells that can differentiate into a variety of cell types including osteoblasts, and adipocytes. This unique process is influenced by platelets that allow for this effective transition. Common to all types of cancers, these platelets contribute to metastasis and tumor vascularization. This commonality between cancer types allowed for a simple question: could one medication be created to isolate and target platelets, thereby reducing cancer growth? Using prior research, I propose innovative and unique solutions to cancer treatment, utilizing the notion of organic nanoparticles to allow for effective treatment. Through this, an underlying basis for future research can be conducted to further study cancer treatments.
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**Presentation Type**: False

**Title**: The Effect of Limb Length on Locomotor Efficiency with Regard to Slope

**Author Status**: Undergraduate student  
**Author Affiliation**: Case Western Reserve University  
**Published?**: True

**Elevator Speech**: Research on locomotor efficiency has suggested that shorter limb length is less efficient. However, Higgens and Ruff (2011) suggested that shorter limbs – specifically, smaller crural indices – may actually be more efficient on sloped terrain. Our data supports this prediction, as it shows that individuals with lower crural indices have longer strides on sloped terrain than individuals with higher crural indices. These results have important implications when considering the evolution of leg length.

**Key Words**: biomechanics, physical anthropology, hominids, locomotor efficiency, slope

**Abstract**: There have been extensive studies examining the locomotor efficiency of hominids. However, these studies have largely focused on locomotion across flat terrain. In reality, terrain is not always flat. Examining the effects of sloped terrain on human locomotion can potentially be very informative on the factors influencing human locomotor efficiency. One such factor that is particular relevance to the hominid fossil record is limb length and crural index (the ratio of tibia length to femur length). Previous research has suggested that shorter limb length is less efficient. However, Higgens and Ruff (2011) suggested that shorter limbs – specifically, smaller crural indices – may actually be more efficient on sloped terrain. Our data supports this prediction, as it shows that individuals with lower crural indices have longer strides on sloped terrain than individuals with higher crural indices. These results have important implications when considering the evolution of leg length in the hominid record, as they show that longer limbs may not be universally advantageous.
This past summer, SOURCE provided me with the opportunity to compose a concerto for Alto Saxophone with wind ensemble accompaniment. I was able to work closely with saxophonist Ryan Rose on creating the soloist part and conductor Dr. Gary Ciepluch on producing a clean score. The concerto is approximately twenty-one minutes in duration and is in four movements. Each movement was approached with the intention of creating varying styles, influences, and tempi that would allow me to grow as a student composer. The first movement is slow and grave, and builds in intensity as it unfolds. It also features modes and scales, particularly the octatonic scale, that differ from the diatonic scale excessively used in common practice western music. The second movement provides an opportunity for the soloist to showcase their virtuosity, and features tone clusters and a jazz influence. In contrast to the second movement, the third movement is a slow development on a chorale, and provides an opportunity for the saxophonist to showcase their lyrical ability. Finally, the fourth movement is a fast and exciting finale in a compound meter and Lydian mode. The Lydian scale has a raised fourth scale degree, which allows for easy modulation to the Dominant, creating a constant forward sense of motion, propelling the piece towards the ending. The concerto accompaniment is scored for a small wind ensemble, including woodwinds, brass, percussion, piano, and harp. The concerto will be performed with CWRU's Symphonic Winds on April 24th in the new Maltz Performing Arts Center. The concert will also feature five other composers recent works and the Jazz Ensemble I.
Lamda Cold Dark Matter (?CDM) has been a successful paradigm for explaining large-scale structure in the universe. However, this model does not provide a satisfactory explanation for local, smaller scale features, such as the dynamics of dark matter dominated low surface brightness galaxies. Observations of rotation curves of these galaxies, as well as the Tully-Fisher relation, provide a way of evaluating ?CDM. Often comparisons need to be made between theory and observation, requiring conversions between theoretical quantities into observational ones. This work uses the newly constructed SPARC catalog, which contains high resolution rotation curves of 173 isolated galaxies and Spitzer [3.6] photometry. We use the stellar-to-halo mass relation from abundance matching in order to find the virial radius for each galaxy. We then examine each galaxy in context to its calculated virial radius and found three galaxies that have observations far out towards the virial radius. Investigating these galaxies further can help evaluate the limits of abundance matching or dark matter models themselves. Additionally, we also plot the Tully-Fisher relation using a percentage of the “virial velocity.” Preliminary results found a scatter higher than that found using a measurement of vflat. Future work can be done as to comparing the Tully-Fisher using the “virial velocity” to the expectations for ?CDM.
The life expectancy of Cystic Fibrosis patients has increased greatly in recent years. As CF patients live into their 30s and 40s, Cystic Fibrosis Related Diabetes (CFRD) has become an increased problem, as the disease can increase mortality by six times. CFRD has multiple factors, which include pancreatic insufficiency and insulin resistance. The trends in CFRD do not match Type 1 or Type 2 diabetes; instead it falls somewhere between the two (1). Current research by Dr. Aura Perez has shown that blood glucose levels in CF mice drop more quickly than the levels in wild type (WT) mice after an injection of glucose. However, after fasting the mice for various amounts of time, female CF mice had significantly more glycogen left in their livers than female wild type mice. This study found that after exercise, CF mice had significantly more glycogen remaining in their liver than WT mice also.

Mice were ran on a treadmill while the inhalation of O2 and exhalation of CO2 were measured. By determining the respiratory exchange ratio (RER) it was seen that under exercise, CF mice exhausted their readily available carbohydrates and switched to burning fat sooner than WT mice. However, analysis of the liver glycogen levels at the end of the exercise period showed that CF mice had higher stores of glycogen remaining after exercise. It can be concluded that CF mice are unable to access their glycogen stores during exercise compared to the WT mice, as well as during fasting. This data indicates altered carbohydrate metabolism which could lead to CFRD in CF patients.

References
New to MCI Drills? Is your service just going through the motions at exercises? Many agencies put their skills to the test with Mass Casualty Incident Drills, but all have room for improvement. Starting from broad goals and working to an Improvement Plan, this presentation discusses taking the MCI drill to the next level with lessons learned from the Exercise Director for two Case Western Reserve University MCI drills. To be a useful tool, a drill needs concrete and measurable objectives to guide the course of events and what is being evaluated. Past initial planning stages, communication becomes paramount to success. Without a well-documented plan, even the best simulations can crumble at the last minute. During the drill all your efforts come together, but without realistic scenarios and control of the exercise, participants will not take it seriously. Most importantly, without a collaborative evaluation, there is little purpose to a drill. This is where plans are made, problems are fixed, and lessons are learned. Focusing on defining objectives, working with other agencies, post-exercise evaluation, and solid FEMA style documentation, participants will learn the details of how to run a successful drill and how to get the most out of it from the Exercise Director of two full-scale exercises.
### Abstract

Stable heteroclinic channels (SHCs) offer an alternate modeling framework for rhythmic activity in biological motor control systems. They combine the robustness of central pattern generators (limit cycles) with the sensitivity of chain reflex systems. We introduce a two-dimensional noisy, twisted stable heteroclinic oscillator as an abstract model for neuronal motor control circuits. To investigate the interplay between stochastic and deterministic steering, we study the effects that both have on the mean return time of the orbits. Through direct numerical simulations, we show that the mean period has a non-monotonic response to noise intensity. We use a mean first-passage time (MFPT) approach to study this phenomenon more quantitatively. In the limit of small noise, semi-analytic results from the MFPT analysis agree with numerical results.
Cardiovascular disease (CVD) and diabetes are two highly prevalent diseases found in the American population. The National Diabetes Education Program states that adults with diabetes double their chances of having a heart disease. Also, high blood glucose, high blood pressure, lipid problems, and obesity in diabetic adults are additional factors that relate to a higher rate of CVD. Furthermore, approximately 65% of people with diabetes die from CVD. A specific type of CVD is coronary heart disease (CHD) that occurs when plaque builds up in the coronary arteries; these arteries supply oxygen-rich blood to your cardiac muscle. Build-up of plaque in the arteries leads to a condition called atherosclerosis. Based on research conducted, there seems to be a genetic relationship between coronary heart disease and diabetes. Additionally, exploring the environmental association between CHD and diabetes would further solidify the existing statistical relationship between the two diseases. For this project, the connection between coronary heart disease and diabetes was explored through an analysis of scientific literature to determine if a correlation existed between genetic and environmental factors.
Background: Developing schistosomiasis (SCH) therapeutic vaccines is undergoing and requires parallel mathematical modeling to quantify the population-level impact of these vaccines.

Methods: We developed a deterministic compartmental model stratified by age, parasite burden, and vaccination status and used it to study the population-level effect of potential SCH vaccines in terms of vaccine durability and efficacies of reducing parasite accumulation, egg release and increasing parasite mortality. We quantified the population-level impact using derived summary measures and quantified the size of the impact under diverse assumptions of target groups, vaccine efficacies and durabilities and endemic settings through dynamic simulations.

Results: From summary measures analyses we found that a durable vaccine with high efficacy of reducing parasite accumulation and egg release and medium efficacy of killing worms (85%, 80%, 50%) has potential for large impact at the population-level. At 10 years waning and frequency of mass vaccinations with this vaccine, host prevalence can reach 3.5% (from 14%) and require the continuation of vaccination. Lower and higher impact is predicted respectively for lower coverage that does not encompass all potential contaminators and higher frequency of mass vaccination that early captures unvaccinated persons. Elimination of schisto using such efficacious vaccine might be possible within two decades and time to elimination can be lowered if mass administration of PZQ to all infected persons in combination with the vaccine is possible.

Conclusion: In communities of mixed risk individuals, it would be difficult to control schisto by vaccines without optimal sustainable coverage. Elimination of schisto might be within reach if MDA is timely combined with highly efficacious vaccines.
Aerogels serve as promising insulation materials due to their porous structures. Montmorillonite clay functions as an abundant and nontoxic aerogel base, taking advantage of the mechanical integrity provided by poly(vinyl alcohol) matrix and the natural insulating properties of keratin fiber additive. Aerogel samples with varying constituent concentrations and molecular weights were subjected to a compression and heat transfer tests to determine the mechanical properties and thermal conductivities. Stress Strain curves with elastic modulus and experimental thermal conductivities are presented. Future work will focus on characterizing a trend in aerogel thermal properties with the addition of polymer and protein.
Physiologic cardiac hypertrophy is an adaptive form of cardiac hypertrophy that can be triggered by chronic endurance exercise training. A number of experimental studies have demonstrated that physiologic plasticity is mediated by defined signaling pathways that are, in part, distinct from those that drive pathologic hypertrophy. BRD4, one of the four mammalian BET proteins, is the most expressed in the heart and is selectively induced with pathological stress. In addition, a specific inhibitor for BET proteins, JQ1, was able to significantly attenuate pathological hypertrophy. However, it remains unknown whether BETs participate in physiologic cardiac growth. Using a well-established ramp-swimming exercise protocol, mice were trained to swim for 90 minutes, twice a day for 28 days. Swimming and sedentary adult mice were randomized to receive either JQ1 (50 mg/kg/day) or vehicle. Physiological cardiac hypertrophy was induced by swimming training as evidenced by echocardiography, gravimetry, histology, and gene expression analysis. However, no significant effect of JQ1 was observed in the swimming group. These results indicate that although critical in pathological hypertrophy, BET proteins do not participate in cardiac remodeling in physiological hypertrophy. This project will lead to further studies over the transcriptional regulation of physiological cardiac hypertrophy and JQ1’s therapeutic index.
The Celebration of Student Writing 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. 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 30 full-time Writing Program faculty and graduate students staff our center. Each year, WRC consultants conduct more than 4,000 individual sessions with approximately 1,200 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, 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 is additionally supported by the SAGES Program and the Department of English.
Courses and Organizations

USNA 287W: Dieting: Dogma, Facts, Fads (Poster #46)

Course Instructor: Shannon Sterne, Kristine Kelly (writing instructor)

Students: Rachel Weisbecker Meagan Smith

Americans spend billions annually on diet products and lifestyle plans, many of which promise that we can “Lose 30 pounds in 30 days!” or “Eat anything and still lose weight!” Students in this SAGES seminar participated in a three-part project and produced a variety of materials reflecting their understanding of the scientific evidence supporting strategies for sustainable weight and health management. They explored ways in which advertising hype can be used to eclipse scientific fact by converting their argumentative paper on the subject into a magazine article. The third component of the project consisted of a PechaKucha presentation of the essay.

FSCS 150: Culture & Globalization (Posters #66 & 67)

Course Instructor: Gusztav Demeter

Students: Sung Gyu Bae, Sun Ho Choi, Yuhang Han, Chenjia Hui, Yuan Yuan Liang, Kenji Miyazawa, Zifeng Ou, Yijie Qiu, Jinglu Wang, Meng Yuan, Yinfou Chen, Zhihao Huang, Sunwoo Kwak, Chongshan Liu, Phong Nguyen, Yifan Wang, Han Xu, Yanyan Yang

The theme of this SAGES First Seminar course this semester was Culture & Globalization. Some of the topics investigated include: globalization and culture; globalization and the arts; globalization and archaeology; and globalization and language. 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 the theme of the course. At the Celebration of Student Writing event, students will display mini-posters of their research essay.

USSY 286S: Shakesploitation: The Making of a Cultural Icon (Poster #76)

Course Instructor: Barbara Burgess-Van Aken

Students: Nurahn Abouzahra, Dominic Adams, Nicole Carosella, Vanessa Chen, Eric Chueh, Clayton Cooper, Reilly Dalleska, Chrissy Gallishen, Bhargavee, Gnanasambandam, Aidan Klemm, Elise Melsom, Robert Park, Oliver Ruhl, Andrew Shao, Alexis Wu, Chris Zhang

Students in this University Seminar have been exploring Shakespeare reception from the seventeenth to the twenty-first centuries applying a variety of literary and cultural theories. For this Celebration of Student Writing, four groups of students have prepared adaptations and re-appropriations of the Bard’s texts.
USSY 285V: Castaways and Cannibals: Stories of Empire (Poster #80)

Course Instructor: Kristine Kelly

Students: Henry Bartholomew, Kelsey Chang, Amy Connerton, Michael Fabiniak, Daniel Gasvoda, Kaelyn Henley, Jonathan Hisnanick, James Kennedy, Quinn Kirby, Andrew Loke, Virginia Maricocchi, Rita Steinberg, Katherine Thompson, Danielle Zheng

Students will present their collaborative digital projects in which they explore issues attending British global expansion during the nineteenth and twentieth centuries. Their projects (which began with general categories like "castaway, cannibal, settler, adventurer") look at the stories of empire from historical, social, and cultural perspectives and consider how the ideologies relevant during the height of the British Empire have been questioned and critiqued in contemporary culture.

CWRU Writing Programs & The Writing Resource Center (WRC) (Poster #56 & 57)

Essays by the winners of the 2015 University Essay Prizes and the First Seminar Essay Prize are available in booklet form. Stop by the WRC table, pick one up, and chat with our consultants about WRC services and programs!

Discussions: The Undergraduate Research Journal of CWRU (Poster #71)

Students: William Qu, James Lee

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. For a recent issue, we received over thirty submissions from fourteen undergraduate institutions located in the United States, Canada, United Kingdom, and Ukraine. 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.