INTERSECTIONS
winter poster session

DECEMBER 9TH, 2011
ADELBERT GYM

Research and Creative
Projects by Undergraduate
Students including Senior
Capstone Students

CASE WESTERN RESERVE UNIVERSITY
EST. 1826
think beyond the possible™
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<th>Group Representative</th>
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<tr>
<td>Hee-Seung Kang</td>
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<td>Quantifying Factors Behind Poor In Vitro-In Vivo Correlation of Drug Release from In Situ Forming Polymer Implants</td>
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<td>Design and Synthesis of Magnetic Core-Shell Nanoparticles</td>
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<td>Suk</td>
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<td>Achieving Cultural Competency to Improve the Delivery of Care to Students in the Cleveland Metropolitan School District</td>
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<td>Leading the Way to Lead Poisoning Prevention</td>
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<td>Surveying Physician Knowledge and Attitudes Regarding Counseling Women on Alcohol Usage Before and During Pregnancy</td>
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<td>Townes</td>
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<td>Mapping to the Frankfort/Sella planes coordinate system using MIPAV (Medical image processing analysis &amp; visualization) and application to tri-planar cephalometric analysis</td>
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<td>Varghai</td>
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<td>Enhancing Mechanical and Solubility Resistance Properties in Poly(vinyl alcohol) Aerogels</td>
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<td>The Education of National Youth Sports Program Participants on Physical Activity</td>
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<td>MRSA Among Gila River Reservation Residents</td>
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<td>False Associative Memory: Exploring the Revelation Effect Using Verbal and Numerical Tasks</td>
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<td>Quantifying Cardio-Respiratory Coupling with an Empirical Oscillator Model</td>
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<td>Effects of Competition Distance and Soil Origin on Plant Invasions</td>
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<td>Zimpelmann</td>
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<td>What's on YOUR Plate? Improving Healthy Food Choices and Nutritional Knowledge at CWRU Squire Valleevue Farm</td>
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<td>Kristen</td>
<td>BIO, SYB</td>
<td>The Effects of Calcium Abundance on Inducible Defenses in Freshwater Snails</td>
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CELEBRATION OF STUDENT WRITING  
DECEMBER 9, 2011

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 letters and lines on the printed page. 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 Center for the Study of Writing, established in 2008 to facilitate research and scholarship on writing at the University and in the world, 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 have 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 also supported by SAGES and the Department of English.
**Writing Wall**

Sponsored by Celebration of Student Writing

Space is provided for Celebration participants and attendees to contribute their own spontaneous acts of composition to this semester’s Celebration event. The Writing Wall is a tradition that honors ephemeral writing and provides space for self-expression – please add your voice!

**Case Reserve Review**

**Representatives:** Rachel Hunt, Parker Castleberry, Alex Warofka, Sarah Jawhari, Jaq Evans

The Case Reserve Review is the official literary magazine of CWRU. We publish graduate and undergraduate student prose, poetry, and photography on a bi-annual basis. We will be displaying our Fall magazine and asking for feedback from other presenters/students as well as providing information about creative outlets on campus.

**Writing Resource Center**

**Representatives:** Megan Swihart Jewell, Writing Center Director; Rob McAlear, Writing Center Assistant Director

The Writing Resource Center (WRC) provides supplemental, discipline-specific writing instruction to students of all levels at the university. Our writing consultants work one-on-one with students on a wide variety of projects. We encourage visits from students at any stage of the writing process, from brainstorming and drafting, to revising and organizing, to sharpening expression. Visit the WRC table at this semester’s Celebration of Student Writing to learn more about the WRC, meet our consultants, participate in fun writing activities, and to get the answers to any and all of your writing questions!
**FSSO 199: PHILANTHROPY IN AMERICA**

**Course Instructor:** Barbara Burgess-VanAken

**Students:** Sahil Bharwani, Kayla Courey, Selina Dziewic, Miles Frankel, Tessa Greene, Shelby Hamilton, Jamie Han, Joe Laucks, Lena McCoy, Ema Peshel, Sanjana Soni, Sue Sriharan, Roger Velasquez, Colin Worden, Sean Yang, Jimmy Yang

Our first seminar explored the topic of philanthropy and social change. After assessing social and physical needs and investigating various genres of nonprofit responses to those needs, we worked in groups to develop hypothetical nonprofit organizations that we feel best address current social problems. Acting as representatives of foundations, each member of the class had a set fund to divide among our organizations any way he or she chose. Today we are displaying our presentations as well as flyers and posters for the nonprofit organizations we have designed.

**USSY 284: THE ART OF MADNESS**

**Course Instructor:** Barbara Burgess-VanAken

**Students:** Jeffrey Brown, Anna Crawford, Katie Dzuricky, Kristin Hande, Kristina Korchevskaya, Sabina Kumar, Allison Luoma, Whitney Miller, Karishma Patel, Chloe Rausch, Aleha Saleh, Alex Shappie, Samantha Tucci, Elizabeth Windham, Silvana Zapata-Ramirez

In the Art of Madness (USSY 284), we read literature from various literary periods that featured characters with mental illness. Using New Historicist and Psychoanalytical theories of literary analysis, we compared perceptions of mental illness over time. Our group presentations addressed social, legal, and medical developments in the early modern period, the eighteenth century, the Victorian era, and the twentieth century. Our celebration includes the power points from these presentations in addition to our syllabus and titles of our final research papers.
A recently coined word, “nanotechnology” is the materials and processing of materials that have at least one dimension in the nanometer size scale. Applications of nano-systems have been validated in the arts, crafts and technologies of ancient civilizations, while future applications are being researched and designed today. Students in this SAGES University Seminar will present the science and the arguments within their individual research projects in poster format.


As we reach the limits of silicon-based electronics, researchers are turning to carbon nanostructures to continue applications of Moore’s Law.


Fiber-reinforced plastics occupy a significant place in structural applications for the automotive and aerospace industries. This paper discusses the applications, advantages and disadvantages of using these materials structurally, economically and environmentally.


Research in the new and exciting domain of Gold Nanoparticles (AuNPs) has promising applications in imaging, diagnostics, and therapy for cancer and other diseases.


Recent developments in nanotechnology can potentially allow for target specific drug delivery using nanoparticles. This could lead to less harmful side-effects and more effective medical treatments for numerous diseases.
ENGL 395: SENIOR CAPSTONE SEMINAR

Course Instructor: Christopher Flint

Students: Elisabeth Farrer, Catherine Kinzig, Tiarra Thomas

This course examines research methods, scholarly resources and analytical skills for prevailing modes of enquiry in English studies. It is intended to be a component of the SAGES program for students interested in conducting a senior capstone project in an area related to English studies. As such, it also fulfills an English major requirement. To fulfill the major writing requirement for the course, students develop a cumulative research endeavor, their capstone project, which may be either a scholarly or creative work. Through the work on this project, students familiarize themselves with local and web-based research tools such as libraries, electronic databases and print indexes, various archives, and InterLibrary Loan. The capstone project culminates in a public presentation of the work at the Celebration of Student Writing.

ENGL 395 PRESENTATION SCHEDULE – COACHES’ AREA, ADELBERT GYM

“Alternate Lives: Reimagining Fame and Influence” 12:00 – 12:30
Elisabeth Farrer

History conventionally assumes the form of stories, narratives that if not appropriately studied, return to haunt us. Famous figures frequently intrigue us because of their impact on our modern world. But there are others as well. Those who are commonly forgotten are the marginalized individuals that influenced the famous people we study and admire. To understand the intricate web of support and influence that makes up our history, this project connects historical research to a poem sequence based on the forgotten ones. By studying biographical texts and original works such as letters, paintings, photographs, and creative writing I have devised a series of poems that peer into the intimate world of acclaimed figures to witness the contributions of those who helped them. Figures such as Ernest Hemingway, Marilyn Monroe, Abraham Lincoln, and Andy Warhol, to name a few, have acquired not only an aura of greatness, but also burdens of regret and haunting influences. My poems concern their influential counterparts, i.e. Clarence Hemingway, Monroe’s divided self, Mary Todd Lincoln, and Edie Sedgwick, and reveal the life behind those we revere. By integrating scholarly research and poetic expression, this project seeks to fully understand the “ghosts of history” using devices employed by poetry, and the art of narratology. Ultimately, my main goal is to reach a wide audience of readers and scholars who might not have before considered their influence on our modern world.

“The Adaptation of Adaptation: How Parody Becomes Classic” 12:30 – 1:00
Catherine Kinzig

“It is a truth universally acknowledged that a zombie in possession of brains must be in want of more brains.” Even if a casual reader does not recognize the first half of this line as the iconic opening words of Jane Austen’s Pride and Prejudice, that same reader might question the
appearance of the eating habits of the undead in a sentence that breathes an air of sophistication. The passage is in fact from an adaptation of Austen’s novel, *Pride and Prejudice and Zombies*, written by Seth Grahame-Smith. A better term for Grahame-Smith’s novel might be parody, though others would venture to call it less friendly terms such as “rip-off,” or what Christine Rosen, senior editor of *The New Atlantis*, calls “a reverse bowdler,” a term she uses to describe the act of essentially dumbing down a work of literature in order to make it easier for its audience. Instead of allowing the terms parody, satire, and homage to describe Grahame-Smith’s novel, she deems it unworthy of such titles. This Capstone seeks to point out what Rosen fails to consider: that this is not a new or shocking enterprise. This sort of “mock-up adaptation” has been around for centuries and has been not only successful but has resulted in classics of its own: even Austen herself is guilty of it, using *Northanger Abbey* to parody gothic fiction found in Horace Walpole’s *The Castle of Otranto*. Rather than condemn a work of fiction because it seeks to make light of a “serious” novel, we can gain an appreciation for the form by examining how it has evolved since the middle of the 18th century and keeps adapting itself to be a stand alone genre that becomes increasingly more accessible as the years go by.

“The Real and the Unreal: Questions of Truth in African American Fiction”  1:00 – 1:30
Tiarra Thomas

The research presented in this study focuses on the African American condition in Jackson, Mississippi and surrounding states, and how it may have been reflected in literature during that time. Books such as *The Help* by Kathryn Stockett and other similar works often present their novels in a manner that makes the story seem “real,” and, in effect, may alter the way that the reader thinks of the story and the historical period. By conducting research related to this, my goal is to confirm that texts based on the African American experience often have a close relationship to the historical events of that time. Using the novel *The Help* and historical information of the era it describes, I examine the relationship between the reality of what is confirmed by history and the way in which that reality is presented in fictional works.
Defining the Mechanism and Evolutionary History of the Spliceosome

Neethu Abraham, Department of Biology

Spliceosomes are large ribonucleoprotein complexes involved in removing introns from eukaryotic pre-mRNAs. The spliceosome is composed of five small nuclear RNAs (snRNAs), designated U1, U2, U4, U5, and U6, and over 150 different proteins and partly due to its complexity, many aspects of its function including the identity of the catalytic domains and its evolutionary history remain unknown. A base-paired complex of only of the snRNAs, U2 and U6 snRNAs, was sufficient to perform a two-step splicing reaction, resulting in a linear RNA product containing portions of both RNA oligonucleotide substrates. The removal of functionally critical regions of U6 including an intramolecular stem loop or evolutionarily invariant sequences resulted in a complete loss of catalytic activity. Similarly, several point mutations in these invariant sequences almost completely blocked product formation. These results suggest that these two regions of U6 snRNA participate in forming the active site involved in catalysis. Using various combinations of point mutations, we will perform in vitro catalytic assays to determine the combinations that rescue the loss of function of individual point mutants, thus indicating the presence of a critical interaction. These data will be used to develop a model which will be compared to the existing information on the organization of the active site of the RNA enzymes in lower eukaryotes and bacteria to determine a possible ancestral relationship.

Project Mentor: Professor Saba Valadkhan, Center for RNA Molecular Biology

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Increasing Utilization of East Side Evening Women’s Reproductive Health Clinic

Amanda Rendall, Department of Nursing; Michael Adams, Department of Nursing

For this summer capstone a clinical group was assigned to the Cleveland Department of Public Health, J.Glen Smith clinic, which is located in Glenville, a community on the east side of Cleveland. The community is over 95 percent African American and suffers from 31.4 percent of its population living below the Federal poverty level (city-data, 2010). It was quickly noticed that many of the members of the community particularly the young women were unaware of steps they could take to protect and improve their reproductive health. After becoming more familiar with the community and working within the agency, the group recognized the need to improve the attendance at the women’s evening reproductive health clinic. It was hypothesized that improving the visibility of the clinic in the community along with better advertising would increase the amount of women who attended clinic during the monthly evening clinic. After a number of different interventions within the community, the group was able to form small and therapeutic relationships with a small portion of those who were are targeted population. In the end, making connections with community partners and those few community members failed to increase the attendance at the evening women’s reproductive health clinic.

Project Mentor: Professor Linda Boseman, MSN, Department of Nursing

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National Youth Sports Program Nutrition in Cleveland, Ward 15

Samantha Andreasen, Frances Payne Bolton School of Nursing; Megan Eller, Frances Payne Bolton School of Nursing; Amy Shearon, Frances Payne Bolton School of Nursing; Amy Zoeckler, Frances Payne Bolton School of Nursing

Ward 15 in Cleveland, Ohio is very diverse geographic location. Through assessment and research, proper nutrition has shown itself as a potential concern and health risk for the children. Will enrichment classes related to health and nutrition with education regarding the right food choice, portion sizes, the food pyramid, sugar
content, and chronic conditions as a result of unhealthy eating, for two and a half weeks increase the children’s knowledge about healthy eating and nutrition, evidenced through 30% improved scores on a post-survey from the same questions given on a pre-survey? This project was based off a population involving campers at the National Youth Sports Program, on Case Western Reserve University’s campus, in Cleveland, Ohio. The objectives were to improve the knowledge of campers about healthy eating and nutrition, view positive results at lunch and snack time the day following a lesson, and help families improve overall nutrition of meals. Methods included assessing baseline knowledge from campers using a pre-survey with information to be covered during lessons about the food plate, food groups with the recommended number of servings, food labels, portion control, healthy snacks, explanations of processed, canned and fresh food, and health conditions such as obesity, hypertension, diabetes, and cholesterol. We followed up with a post-survey and found a 30% improvement in scores from the beginning of lessons. In the future, it is our hope that nutrition is taught to all school-aged children in the Cleveland Metropolitan School District, as well as continually to be taught during the National Youth Sports Program.

Project Mentor: Ebony Hardee, Frances Payne Bolton School of Nursing

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Effectiveness of Self-Esteem Education in Cleveland Youth

Barnes, Nichole; Frances Payne Bolton School of Nursing; Christman, Sarah, Frances Payne Bolton School of Nursing; and Doho, Lucienne, Frances Payne Bolton School of Nursing

The National Youth Sports Program (NYSP) is a five weeks sports program for children ten to sixteen years old, in which ten nursing students along with other faculty members lead both educational and physical activities to Cleveland and Lorain children. For the first two and a half weeks of the program, we were involved with enrichment or educational activities. Our lesson plan was based on self-esteem. We identified self-esteem as important because they are many influences that may affect a child’s self-esteem such as family, living situation, socioeconomic status, class, age, gender, race, friends, relationships with family, grades etc. The “Good Question” we developed for our project was: “Will doing self-esteem education every day for 50 minutes with the NYSP campers, aged 10-16 years, during classroom enrichment sessions every day for two weeks increase knowledge about self-esteem by 5% as measured by an increase in correct answers on a multiple choice survey?” We developed and implemented six learning activities related to self-esteem to 100 students. Each session lasted approximately 50 minutes. These six different lesson plans were evaluated through pre and post-test surveys. At the conclusion of our two weeks of teaching, we had an increase in a little over 11% in knowledge about self-esteem. The children also verbally expressed what they had learned and how they planned to apply their knowledge and lessons learned to life.

Project Mentor: Ebony Hardee, Frances Payne Bolton School of Nursing

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Promoting Awareness and Providing Outreach at Cuyahoga County’s Family Planning Clinic

Hannah Beers, Frances Payne Bolton School of Nursing; Jill Belsan, Frances Payne Bolton School of Nursing; Mary Clare McFadden, Frances Payne Bolton School of Nursing; Abby Reynolds, Frances Payne Bolton School of Nursing

Throughout our ten week Capstone experience at Cuyahoga County Board of Health, our main objective was to promote the Title X “My Life, My Body” Family Planning Clinic within the community. We focused on marketing the clinic due to increasing sexually transmitted infections (STI) and adolescent pregnancies in the Cuyahoga County area. Throughout our 10 weeks at the family planning clinic there was an increase of 33 new clients. The Title X Clinic provides birth control information and services, emergency contraceptives, HIV/STI/pregnancy testing, counseling, and educational resources. These services are provided on a sliding scale based on
income. In order to provide educational outreach for the Family Planning Clinic, we posted informational fliers in a variety of local businesses, we chose businesses that targeted clientele ages 13-24 years old, such as bars and restaurants. In addition, we provided outreach programs to local colleges and universities: Cuyahoga County Community College West, Case Western Reserve University, and John Carroll University. At the campuses we manned stations with brochures, pamphlets, and condoms, and were available to answer any questions that the students’ had. Furthermore, we promoted the clinic through various forms of media, specifically focusing on community websites including googlemaps, and local radio stations such as 90.5, 96.5, 99.5. It is our expectation that through our marketing of the Family Planning Clinic there will be an increase in the number of clients who seek services at the clinic during the coming year.

*Project Mentor: Dr. Sarah Gueldner, Frances Payne Bolton School of Nursing*

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**Quantifying Factors Behind Poor In Vitro-In Vivo Correlation of Drug Release from In Situ Forming Polymer Implants**

Ashlei C. Beiswenger and Luis Solorio, Department of Biomedical Engineering

The underlying variables leading to the disparity between the mass of drug released from phase sensitive in situ forming implants formed in vivo and those formed in vitro is complex. In this study, the surface-to-volume ratio and limitations on implant expansion were evaluated and compared to previous data from in vivo implant release. Polymer solution loaded with sodium fluorescein was injected into agarose phantoms to form sheets (1.5 mm and 3.0 mm), then placed in 37°C phosphate buffered saline (PBS) solution. Unconstrained spherical implants were formed by dropping polymer into PBS. Drug release was measured over one week and compared to in vivo data. Data shows that the release from the 1.5 mm implants was greater than that of the 3.0 mm implants due to the increase in surface-to-volume ratio (2.1 and 1.5, respectively); however, this difference is not significant enough to account for the elevated release occurring in vivo. We hypothesize that reaction forces generated at the injection site lead to elevated release from the implants, which we speculate resulted in the secondary burst of drug observed from the constrained implants. Therefore, we postulate that while surface-to-volume ratio is a factor contributing to elevated release, the poor correlation observed cannot be accounted for by changes in surface-to-volume ratio alone.

*Project Mentor: Professor Agata Exner, Departments of Radiology and Biomedical Engineering*

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**The Effects of Diet on Adipose Tissue Composition in Mouse Models of Cystic Fibrosis**

Kaeleen Boden, B.A. Biology and Cognitive Science; Ilya Bederman, PhD, Mitchell L. Drumm, PhD, Department of Pediatrics, Case Western Reserve University.

Cystic fibrosis (CF) is a lethal inherited disease characterized by pulmonary infections, exocrine pancreatic insufficiency, and low BMI (body mass index). CF patient BMI maintenance and improvement is an important clinical goal because it has been shown that BMI directly correlates with pulmonary function and survival. Following current dietary recommendations, CF patients consume diets high in saturated fat to increase adiposity. This strategy has successfully increased their body fat, but CF patients can also develop CF-related diabetes and CF-related liver disease. Since high-fat diets in the non-CF population attribute to the development of obesity and diabetes, we reasoned that the high-fat diet prescription may not be optimal to prevent those CF associated co-morbidities. In order to further elucidate this premise, we examined qualitative and quantitative parameters in the adipose tissue of CF mouse models to analyze the metabolic fates of various fatty acids depending on their chemical structure. We used alkaline chemical extraction to measure profiles of triglyceride-bound fatty acids of the adipose tissue and gas chromatography-mass spectrometry to measure fatty acid
concentrations. We reasoned that high-fat diet feeding will cause increased growth of adipose tissue in CF mice as it does in non-CF mouse models of obesity. We also fed non-CF and CF mice diets with varying origins of macronutrients (animal and plant) to determine if plant based diets are better alternatives to animal based diets because of their high content of essential fatty acids and antioxidants. The results to this study could influence the recommended dietary intake for CF patients in the future.

*Project Mentor: Ilya Bederman, Department of Pediatrics*

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**The Effect of Canopy Cover on Wood Frog Metamorph Locomotion**

*Matthew Boes, Department of Biology*

The environment in which an organism develops has a substantial effect on its adult life. Environment can also affect animals after they have left this environment. Frogs are an excellent specimen to examine because they exhibit strong phenotypic plasticity while a tadpole, and as adults, their locomotor performance can easily be evaluated. When examining aquatic environments, we often examine pond canopy cover (i.e., the amount of the upper foliage of the trees surrounding the pond). Open canopy ponds (ponds with less than 75% canopy cover) have increased species richness and predator abundance, but closed canopy ponds (ponds with more than 75% canopy cover) show increased competition and decreased vegetation. We examined two questions: (1) does canopy cover during the tadpole stage affect locomotion in metamorphs? (2) is frog morphology related to locomotor performance? We collected frogs from six ponds and measured their maximum jump distance and endurance. After the trials we measured snout-vent length, head width, and four leg measurements. We obtained the relative lengths by regressing log transformed leg length onto log transformed mass and using residuals as a measure of relative size. We used analysis of variance (ANOVA) to examine if canopy cover during the tadpole stage affects locomotor performance and morphology after metamorphosis. Frogs that had developed in closed canopy ponds could jump longer distances and had larger snout-vent lengths. Snout-vent length positively affected maximum jump distance and that a longer leg length caused an increase in endurance speed. This shows that phenotypic plasticity has post metamorphic effects and impacts post metamorphic locomotion. These results further demonstrate the importance of tadpole environment and how the tadpole environment may affect post metamorphic locomotor performance and morphology.

*Project Mentor: Professor Mike Benard, Department of Biology*

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**Achieving cultural competency to improve the delivery of care to students in the Cleveland Metropolitan School District**

*Laryssa Hess, Frances Payne Bolton School of Nursing; Chan Suk Park, Frances Payne Bolton School of Nursing; Annie Bosch, Frances Payne Bolton School of Nursing; Yang Liu, Frances Payne Bolton School of Nursing; Pan She, Frances Payne Bolton School of Nursing/ Wuhan University, China*

The Cleveland Metropolitan School District (CMSD) serves the educational needs of a diverse population of children who come from varied developmental, racial, religious, ethnic, educational, and economic experiences. These experiences form their culture and shape their perception of the world. Students from the Frances Payne Bolton School of Nursing frequently interact with CMSD children through weekly height and weight screenings for the community engagement projects. To ensure that the nursing students provide effective and efficient care, it is important that nursing students are able to demonstrate cultural competency. The purpose of this project was to identify an intervention that could increase nursing student’s awareness and appreciation of cultures different from their own to improve the delivery of care to CMSD students. We created an interactive workshop focused on
providing information on the definition of cultural competency, demographics of CMSD, and effective delivery of healthcare. The information was presented through lecture, video clips, and discussions. Prior to the workshop, the nursing students completed a pretest to evaluate their baseline understanding of cultural competency. Following the workshop, the student took a posttest to evaluate the efficacy of the workshop. Students were also asked to comment on the presentation, as well as specific suggestions for future presentations.

*Project Mentor: Dr. Cheryl Killion, Frances Payne Bolton School of Nursing*

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**Reconstruction of the Body Mass Index Parent Notification Letter for the Cleveland Metropolitan School District**

**Stephanie Campbell**, School of Nursing; **Marion Lyman**, School of Nursing; **Amber Maciak**, School of Nursing; and **Meghan Snook**, School of Nursing

Childhood obesity has become an epidemic across the United States. Recent data collected by FPB School of Nursing faculty and students document that 42% of children in the Cleveland Metropolitan School District have body mass indexes (BMIs) in the overweight or obese levels, with over 26% of those in the obese level. This high rate of childhood obesity is of great concern due to the co-morbidities of obesity. Research shows that to help improve the health behaviors and BMI of overweight or obese children parental involvement is critical. After a child has a BMI screening in the Cleveland Metropolitan School District, a parent notification letter is sent home to families with the results of their child’s BMI. Our project aimed to reconstruct this letter because it was not written at an appropriate reading level, poorly defined BMI, lacked information for parents about healthy eating practices and physical activity interventions, and a list of local resources that parents could use help their child become healthier. A literature review of evidence-based best practices pertaining to our topic was completed. In addition we surveyed BMI parent notification letters from other school districts in Ohio. These efforts resulted in a reconstructed Body Mass Index Parent Notification Letter with a fifth grade reading level, a clear explanation of what a Body Mass Index measurement is, nutritional and physical activity interventions parents can follow to improve their child’s health and a current local resource guide of activities and agencies available for Cleveland Metropolitan School District families to help their child achieve and maintain a healthy weight. This letter will be a positive addition to the Cleveland Metropolitan School System's parent notification resources.

*Project Mentor: Marcella T. Hovancsek, RN, MSN. FPB School of Nursing*

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**Communication Across Cultures in a Cleveland Public Health Department Health Center**

**Clare Fagerholm**, Frances Payne Bolton School of Nursing; **Katie Carlile**, Frances Payne Bolton School of Nursing

Cultural differences between patients and healthcare providers increase potential for miscommunication. The Cleveland Public Health Department at McCafferty Health Center, which provides outpatient reproductive health services, receives clients with a wide mixture of ethnic backgrounds. A total of 59% of the clinic’s patients are non-Hispanic African American, 24.7% are white non-Hispanics, 10.5% are white Hispanics, 0.8% are Asian, and 0.8% are Hispanic African Americans. Multiple racial and ethnic identities, combined with language barriers, present challenges to clinic staff as they work to assess, treat, and educate patients in a culturally competent manner. To address this issue, we developed an education program for the staff. Our project included a 30-minute educational session with McCafferty Health Center staff centered on cultural competency and translator ethics. The session includes statistics relevant to the ethnic variety found in the Detroit-Shoreway neighborhood, the
definition and importance of cultural competence, ways to increase cultural competence, and an interactive case study exploring the needs of a Hispanic Limited English Proficient patient. Based on pre-and post-test results, we found a __% increase in knowledge related to culturally competent care. Reproductive health care is already a delicate subject for many populations, and ensuring that healthcare personnel are equipped to receive patients from various backgrounds is imperative for quality and culturally sensitive healthcare.

*Project Mentor: Dr. Cheryl Killion, Frances Payne Bolton School of Nursing*

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**ENGINEERING VIRAL NANOPARTICLES FOR APPLICATIONS IN MEDICINE: Developing CPMV as a platform for efficient intracellular delivery of therapeutics**

*Kevin Chen*, Department of Biomedical Engineering; *Ibrahim Yildiz*, Department of Biomedical Engineering; *Karin Lee*, Department of Biomedical Engineering; and *Nicole F. Steinmetz*, Department of Biomedical Engineering, School of Medicine

Viral nanoparticles (VNPs), such as the plant virus *Cowpea mosaic virus* (CPMV), have been used for various biomedical applications. The nanoparticles formed by CPMV are a robust scaffold for various chemical conjugation methods, and this allows decoration of the nanoparticle platform with targeting ligands and therapeutics. We have demonstrated the tissue-specific delivery of VNPs in preclinical mouse models, laying the foundation for targeted drug delivery. In this study, we describe the loading of fluorescent and therapeutic cargos through infusion into the VNP carrier. Cargo delivery into cancer cells is studied in vitro.

In a proof-of-concept experiment, fluorescent dyes were loaded inside the VNPs through infusion/interactions with the encapsulated nucleic acid. In addition, N-hydroxysuccinimide and hydrazone chemistries were employed to modify the particle surface with different dyes to allow tracking of the VNPs in cells. The same type of chemistry is also used to introduce targeting ligands to induce tissue specificity.

We confirmed chemical modification of the CPMV surface with a highly reactive, specific and UV-traceable hydrazone linker for efficient bioconjugation. Confocal microscopy allowed to follow trafficking of the VNPs in cells and to visualize cargo delivery. Further, we showed that chemical engineering of cell penetrating peptides or other targeting ligands significantly enhances cell-specific uptake (by the factor 10), and allowed the delivery of cargos into cells. In ongoing studies, we are expanding these design principles for the delivery of therapies. We hope to further engineer CPMV particles with other therapeutic molecules for drug delivery.

*Project Mentor: Professor Nicole F. Steinmetz, Department of Biomedical Engineering, School of Medicine*

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**Assessing Community Perceptions of Sexually Transmitted Infections in Rural Alaska**

*Erika Cheung*, Frances Payne Bolton School of Nursing

Chlamydia (CT) and gonorrhea (GC) are the two most commonly reported sexually transmitted infections (STIs) in the United States, and their prevalence is greatest in those less than 25 years old. Research shows that teenagers tend to engage in many risky behaviors such as casual sex, multiple partners, and incorrect/inconsistent condom use. In 2010, Alaska ranked #1 and #2 as the state with the highest CT and GC rates per capita, respectively, and youth aged 15-24 represented over half of all cases statewide. The communities in the Yukon-Kuskokwim Delta lack formal STI prevention efforts, despite the region’s heavy concentration of CT/GC cases within the state. Other than the limited education provided in some schools, Alaskan teens have few resources to turn to for reproductive health and safe sex information. In order to determine the community’s perception of the problem, I conducted a series of interviews with key leaders in Bethel, the central hub of the YK Delta. The data
analysis illustrated that cultural beliefs, casual sex, and lack of education were common perceived reasons for the region’s high STI rates. Many of the interviewees also felt that youth could be capable of stimulating community change, if given the opportunity. As a result of the assessment, I worked through the Bethel Regional Public Health Center to form an STI Prevention Coalition in partnership with many local agencies. The current goal of the coalition is to research and adopt a prevention program to educate youth with basic and accurate knowledge about STI/HIV prevention to empower them as peer advocates within the community.

Faculty Advisor: Dr. Mary T. Quinn Griffin, Frances Payne Bolton School of Nursing

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A New Crocodylomorph Skull from the Lower Belly River Group (Campanian) of Southern Alberta, Canada

Matthew Clemens - Departments of Anthropology and Evolutionary Biology

Crocodylians formed an important part of the late Cretaceous paleocommunities of Laramidia. Although at least 5 taxa are known from the late Cretaceous (Campanian) sediments, ranging from Mexico to the North Slope of Alaska, much of the material is based on isolated scutes, vertebrate, and teeth frequently recovered from microvertebrate fossil assemblages. Most taxa are known from a small number of skulls or diagnosable skull elements, with associated postcranialia being rarely recovered. I report here the first significant crocodylomorph specimen collected from the lower Belly River Group of southern Alberta. The specimen consists of a weathered partial skull comprising the posterior portion of the skull roof and the complete occipit. The specimen was surface collected from badlands adjacent to the Milk River. Although the contact for the Foremost and Oldman formations is present in the region, the coaly matrix covering the specimen indicates that it originated in the uppermost Foremost Formation. Phylogenetic analysis of the specimen indicates that it is similar to the neosuchian Gilchrestosuchus from the underlying Santonian-aged Milk River Formation, but probably represents a new taxon making it the first crocodylomorph to be identified from the Foremost Formation.

Project Mentor: Dr. Michael J Ryan - Curator of Vertebrate Paleontology, Cleveland Museum of Natural History

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Who ate all the snails? Multiple predator effects and refuge use in Belostoma/snail interactions

Mathew L. Conger, Department of Biology

Predation is one of the most important factors in the life of an organism. The rate of predation varies from system to system based on numerous interacting variables. I investigated two of these variables in Belostoma/snail interactions: 1) multiple predators, and 2) refuge use. The presence of multiple predators has been shown to reduce risk to prey when predators fight each other and to enhance risk when predators ignore each other. In the first experiment, I examined potential multiple predator effects in the giant water bug, Belostoma, a known snail predator. Two treatments consisting of a single Belostoma or two Belostoma were set up. I found no difference in snail predation rate between the two treatments suggesting there are no multiple predator effects between Belostoma individuals. Previous research has shown snails will retreat into "refuge" microhabitats when faced with predation. In the presence of open water predators (e.g., fish), snails choose benthic cover refuges whereas in the presence of benthic predators (e.g., crayfish), snails retreat to the water's surface. This behavior allows them to avoid areas these predators are most likely to feed in. The second experiment examines the predation rate of Belostoma on Helisoma snails between tanks with and without a benthic refuge. Results from this should help determine if snails can effectively react to the predation patterns of Belostoma or could show that Belostoma have adapted to take advantage of snail's responses to fish and crustacean predators. Though predation rate is a critical variable in biological systems it can be altered by other interacting variables.

Project Mentor: Professor Michael Benard, Department of Biology
Flax Genome Changes

Kaitlin Coyle, Department of Biology and Christopher Cullis, Department of Biology.

Flax (*Linum usitatissimum*) undergoes a variety of genomic rearrangements in response to environmental stresses such as those caused by nutrient imbalance or heat that can be inherited in subsequent generations. Pl, L, and S are all closely related, with Pl being the progenitor line that changes in response to environmental stress, and L and S being stable genotypes derived from Pl. Complete genome sequencing of Pl, L and S has identified a series of loci that are different between the treated lines in addition to the well characterized *Linum Insertion Sequence-1* (LIS-1), a 5.7 Kb sequence of DNA that is inserted into a conserved target sequence while some varieties of flax grow under stress. The genome sequences around these regions that are different have been used to design primer pairs and the primer pairs used in polymerase chain reactions to amplify the genomic fragments. The PCR amplifications have confirmed the sequence structure and the variation identified between lines. These same primers have also been used to determine the status of the loci in plants while they are growing under the various environmental treatments to determine whether or not they respond similarly to that previously observed for LIS-1.

*Project Mentor: Prof. Christopher Cullis, Department of Biology*

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Neural Basis of Dehumanization

Abigail Dawson, Department of Cognitive Science; Megan Norr, Department of Cognitive Science; and Anthony Jack, Department of Cognitive Science

Dehumanizing language has been discussed in various contexts, including feminist theory, healthcare, and the sociology of war and atrocity, yet to date little work has shed light on how dehumanization works as a way of thinking. To rectify this gap, we conducted a neuroimaging study of the neural basis of dehumanization. We constructed stimuli which depicted unfamiliar individuals in a manner designed to either humanize or dehumanize them. These depictions were guided by Haslam’s (2006) two process theory of dehumanization, according to which individuals may be dehumanized either by likening them to animals or by likening them to machines (aka ‘objectifying’). A number of studies have shown that there is an antagonistic relationship between two large brain networks, known as the task positive and default mode networks. Work from our laboratory shows that this antagonism reflects a reciprocal inhibitory relationship between adopting an empathetic perspective (social reasoning) and adopting a detached analytic perspective (mechanical reasoning). We find that overall, humanizing stimuli evoked the social reasoning (default mode) network more while dehumanizing stimuli evoked the mechanical reasoning (task positive) network more. This is consistent with the idea that dehumanizing causes us to think of people as objects devoid of intrinsic value, whereas humanizing evokes a competing perspective in which people are empathized with and valued. Haslam’s two types of dehumanization differentially affect these two networks. Mechanistic dehumanizing (aka ‘objectifying’) stimuli operate by decreasing response within the social reasoning network, whereas animalistic dehumanizing stimuli operate by increasing response within the mechanical reasoning network. Hence these two forms of dehumanizing operate via complementary mechanisms that influence the different sides of the two antagonistic networks.


*Project Mentor: Dr. Anthony Jack, Department of Cognitive Science*
Social Support in PTSD: An Analysis of Gender, Race, and Trauma Type

Hannah DeLong, Department of Psychology

The current study discusses social support systems and ways they impact persons diagnosed with posttraumatic stress disorder (PTSD). This study analyzes three different variables (race/ethnicity, gender, and trauma type) in a group of 200 adults diagnosed with PTSD. Three measures, the Social Support Questionnaire (SSQ), the Inventory of Socially Supportive Behaviors (ISSB), and the Social Reactions Questionnaire (SRQ) will be utilized to compare differences in the three variables: race/ethnicity, gender, and trauma type. These variables will be analyzed using means-descriptive analysis, and basic ANOVAs on SPSS software. Several studies have shown that social support is crucial to the effectiveness of treatment after the development of PTSD. Indeed, some support has been found indicating that certain populations (women, minorities, and those who experienced childhood sexual assault) may be more vulnerable to experiencing low or negative social support. The current study will compare social support within these variables to discover which populations may be particularly vulnerable to a lack of social support.

Mentor: Norah Feeney, Department of Psychology

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Granulysin in Immune Control of *Mycobacterium tuberculosis* in Older Adults

Matthew Dimaano, Department of Biology

Tuberculosis (TB) remains a serious health issue for the elderly. Previous studies have shown that many cases of active TB in elderly people are caused by reactivation of a latent infection. This indicates that the adaptive cell mediated immunity of elderly people has declined, which allowed *Mycobacterium tuberculosis* (MTB) to proliferate. Granulysin, a protein in the granules of cytotoxic T cells, kills MTB by targeting the bacilli membrane. Therefore, I hypothesize that abnormally low granulysin expression in the cytotoxic T cells of elderly people contributes to their increased risk of TB reactivation. To test this hypothesis, blood samples collected from elderly and young individuals are stimulated with superantigen, stained with fluorescent antibodies, and are examined by flow cytometry. Additional cytotoxins, granzyme B and perforin, were also observed to test other possibilities for the decrease in immune control of MTB in the elderly.

Project Mentor: David Canaday, Geriatric Research, Education and Clinical Center (GRECC), Cleveland VA

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The effects of reading ability on verbal reasoning tasks when no restrictions are placed on testing time

Cynthia Dines, Department of Psychology, Department of Cognitive Science

People with reading difficulties are at a disadvantage on time limited tests of verbal knowledge. In the present study college students were given ample time to take multiple choice tests of the use of words in sayings, similarities and analogies. One set of tests required specific scientific, literary or historic knowledge. A second set required only knowledge of words in common use. Students also filled out a questionnaire as to their comfort level and difficulty with reading in general. People who reported more difficulties with reading were less able to solve tests of sayings similarities and analogies requiring specific knowledge. A similar trend was found for tests involving common words. However, multiple regression analyses revealed that the ability to solve verbal problems based on common terms was not associated with self-reported reading difficulties once extent of specific knowledge was taken into account.

Project Mentor: Professor Joseph Fagan, Department of Psychology
Diabetes in Pima Indians of the Gila River Indian Community

Jennifer Doak, Frances Payne Bolton School of Nursing, BSN, Kate Klingensmith, Frances Payne Bolton School of Nursing

Pima Indians on the Gila River Indian Reservation in Arizona have one of the highest incidences of type 2 diabetes mellitus in the world. Fifty percent of Pima Indians who are between the ages of 30 and 64 have diabetes, of which, 95 percent are overweight or obese. Even more of the population is considered pre-diabetic or at risk because of their sedentary lifestyle, unhealthy diet and heritage. Compared with the United States population, Pima Indians die an average of twenty years earlier, with diabetes being the fourth ranked cause of death after heart disease, cancer, and unintentional injury, respectively. In order to decrease the morbidity and mortality rates of diabetes in Pima Indians, it is important to educate as many patients as possible on the management and prevention of the disease. Since diabetes mellitus is a treatable and preventable disease, increasing the awareness of diabetes in this population would help decrease the diagnosis rate and the rates of poorly managed cases. Discharge instructions for the emergency room and out-patient clinic on the prevention and management of diabetes will hopefully increase the knowledge and compliance of diabetic self-management. Diabetes affects the majority of people on this reservation in some way; therefore, an intervention of this type would benefit a large amount of patients seen in the emergency room and in the out-patient clinic.

Project Mentor: Ebony Hardee, Frances Payne Bolton School of Nursing of Nursing

Simulating the Self-Assembly of Magnetic Nanoparticles

Phillip Durachinsky, Engineering Physics

Magnetic nanoparticles are a functional material with many potential applications, including medical imaging. Due to their magnetic properties, they can self-assemble in solution into a variety of structures when a magnetic field is applied. One imaging modality that has been proposed is Magnetic Particle Imaging (MPI), which detects the nonlinear response of the particles to an applied radio-frequency magnetic field. The self-assembled structures have been produced experimentally, with techniques and results published. However, a nanoscopic theoretical description of the particles and their agglomeration has not been developed, and is essential for optimizing materials. The goal of this project is to develop a particle based simulation capable of predicting the phase diagrams of these self-assembled structures based on parameters such as the applied magnetic field strength and concentration. These predictions will be compared with experimental data. Ultimately, we would like to extend the simulation to represent faithfully the physical picture corresponding to an MPI experiment.

Project Mentors: Professor Robert Brown, Department of Physics; Professor Timothy Atherton, Department of Physics, Tufts University

Linking Skeletal Anatomy with Behavior: Cuneiform Morphology and Arboreality in Hominidae.

Phoebe Edwards, Department of Anthropology

Due to the incomplete nature of the hominin fossil record, it is important to get as much behavioral information as possible out of every bone found. Analyzing skeletal characters that are associated with certain behaviors provides a useful tool for interpreting such fragmented evidence. This study attempts to link aspects of the midfoot bones in humans and great apes with locomotion- specifically the degree of arboreality observed in each species. By comparing articular surface proportions and relative length of the intermediate
cuneiform and the lateral cuneiform to the known behavioral data, it will be possible to see which characters are reliably correlated with arboreality in the Hominidae family. To examine these characters, measurements were taken from the Haman-Todd collection at the Cleveland Museum of Natural History using 40 humans, 20 chimpanzees, and 20 gorillas, with half of each species being male and the other half female. Analysis of the midfoot measurements shows there are clear differences between humans and apes as a consequence of their unique adaptations to bipedality or arboreality.

*Project Mentor: Professor Scott Simpson, Department of Anatomy*

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**Shallow Impurities in Semiconductors**

Jacob Emmert-Aronson, Department of Physics and Department of Mathematics

Semiconductors have found many uses in modern society, most notably as the basis of modern electronics. But very often, the properties of the pure semiconductor crystal are not conducive to practical applications, behaving as an insulator at low temperatures, and having variable conduction properties as temperature increases. This is overcome through the process of doping, introducing impurities to the crystal in order to create charge carriers within either the valence or conduction band of the semiconductor and more finely control its conduction properties. In this research, we implemented a method to calculate the binding energy of a class of impurities known as shallow acceptor states using the effective mass formalism. Within this formalism, the effect of an impurity is to modulate the wave-function of the pure crystal by a slowly-varying envelope function, which behaves as a charge carrier with some effective mass usually distinct from the mass of the electron. By using this framework, we were able to calculate the binding energies of a variety of impurities in III-N crystals such as Gallium Nitride, as well as II-IV-N2 crystals such as Zinc-Germanium Nitride. We further identify directions for improvement in current implementations of the effective mass theory.

*Project Mentor: Professor Walter Lambrecht, Department of Physics*

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**Improving Immunizations in Shaker Heights**

Veronica Epelbaum, Department of Nursing

The Shaker Heights Health Department services a population of 27,000 people with a great diversity in socioeconomic status. The children of the south Shaker neighborhoods have been found to have lower immunization rates than other parts of the community. Immunizations are a necessary public health intervention because they protect children from dangerous childhood diseases that can have serious complications, including death. Children under 5 are especially susceptible to disease because their immune systems have not built up the necessary defenses to fight infection. During the the H1N1 outbreak in 2009 when the Shaker Heights Health Department offered flu shots, the neighborhoods of South Shaker had the lowest percentage of vaccination during this outbreak, ranging from 0.1% to 3.99% (Ohio Department of Health, 2009). Because of these concerning statistics, a Summer Shot Clinic was put together by the Shaker Heights Health Department in an attempt to target these neighborhoods and improve immunization rates as well. Community outreach was the main public health intervention used. Members of the community were taught about the importance of this clinic and encouraged to spread the word. The goal for the clinic was to have 12 people attend. 16 people came to the clinic with the Tdap vaccine being the most frequent shot given. The clinic was successful in targeting the neighborhoods of south Shaker and was able to provide vaccines to some of the residents, while also building a better relationship between the community and the health department.

*Project Mentor: Jesse Honsky, Department of Nursing*
Accounting for the Sun's Gravity in Dark Matter Detection

Bill Flaherty, Department of Physics; Glenn Starkman, Department of Physics; and Craig Copi, Department of Physics

Dark matter is thought to compose a large fraction of the energy density of the universe, particularly our galaxy. The favored candidate for dark matter is weakly interacting massive particles (WIMPs), particles tens to hundreds of times the mass of protons. Scientists have built and are building detectors to look for such WIMPs passing through the Earth. An important factor in determining the signal of the WIMPs is their velocity distribution. It has also been noted that as the earth moves around the sun, the velocity of the Earth through the galaxy adds to the sun's or subtracts from it, depending on the time of year. This modulates the actual velocity distribution of the WIMPs passing through the Earth, and our detectors. Surprisingly, the fact that WIMPs approaching the Earth must fall deep into the Sun's gravitational potential well has not apparently been taken into account in determining the WIMPs' velocity distribution. Since that should cause an approximately few to ten percent change in the WIMP velocity it is not a negligible effect. In particular since it will increase the velocity of the fastest WIMPs, it should increase the detectability of WIMPs. It may also increase the detectability of the annual modulation of the WIMP signal as the Earth moves around the sun. This project calculates the effect of falling into the Sun's gravitational well on the WIMP velocity distribution as seen by an observer on the Earth, and determines the influence on dark matter detector signals.

Project Mentor: Glenn Starkman, Department of Physics

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Patients' Perceptions of Immediate Pain Relief in Traditional Chinese Medicine: Comparison of Acupuncture and Interferential Current Therapy

Alyssa Fledderjohn, Frances Payne Bolton School of Nursing; Joelle Roy, Frances Payne Bolton School of Nursing

While there is a demand for more studies to determine the benefits of traditional Chinese medicine (TCM), there is a growing evidence base on its use in the treatment and management of pain. Acupuncture often treats a wide range of chronic diseases by inserting needles in particular points on the body. Interferential current therapy (IFC) is a modernized version of the traditional practice of cupping, using electrical currents to stimulate muscle and nerve tissues to alleviate acute pain. In a community health center in the Qingshan district of Wuhan, China, there is a recognized TCM clinic where we compared patients’ perceptions of acupuncture combination therapy (acupuncture with electrical stimulation and heat) with IFC on immediate relief in patients with both chronic and acute pain. With the interpretation and translation help of the nursing staff and students of Wuhan University, we interviewed 43 patients about their opinions of TCM as well as the background of their pain to determine if one treatment would be more effective than the other. Using a ten point visual analog pain scale, we measured pain levels before and immediately after treatment and found an overall average decrease of 1.43 points in the 18 patients who received acupuncture combination therapy and a 3.31 point reduction in the 19 patients who received IFC. We also utilized a self-assessment tool with a Likert scale to survey the patients’ perceptions of the improvement of their functional status. Of the 17 respondents of this survey, all either agreed or strongly agreed that their treatment had increased their ability to do certain activities of daily life, had decreased their pain, and that they would choose that particular treatment again. Overall it is evident that TCM plays an important role not only in patients’ healthcare treatments but also in their quality of life.

Project Mentor: Dr. Mary T. Quinn Griffin, Frances Payne Bolton School of Nursing
An Effort to Increase Knowledge about the Effects of Diabetes on the Body

Clay Fritz, Frances Payne Bolton School of Nursing; Tessa Polakowski, Frances Payne Bolton School of Nursing

The Catholic Charities Free Health Care Center is an outpatient clinic located in downtown Pittsburgh, Pennsylvania. The Center provides free health care and dental services to people who do not qualify for Medicare or Medicaid and cannot afford private insurance. One of the most common conditions in this patient population, and surrounding community, is Diabetes Mellitus Type II. This may be attributed to many factors such as: sedentary lifestyle, poor food choices due to the overwhelming low cost, high calorie food options readily available in our society, limited exercise, and family history. Patients are often instructed on the importance of healthy eating, exercise, and managing their blood glucose level. However, the potential effects of uncontrolled diabetes on the body systems is a topic less commonly discussed. In an effort to increase patients’ knowledge in this area, educational posters relating to the long-term effects elevated blood glucose on the eyes, kidneys, nerves, blood vessels, heart, and pancreas were created and placed in each of the Center’s examination rooms. A total of fifty pre and post tests were completed by a random sample of medical patients and analyzed to assess the effectiveness of the posters. As evidenced by the improvement in the survey scores, we can conclude that the posters are a valuable teaching method.

Project Mentor: Ebony Hardee, Department of Nursing

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Resources for the in vivo investigation of alternative splicing in C. elegans

Charles Fulco, Departments of Biology and Biochemistry

Alternative splicing, the process by which multiple messenger RNAs are generated from precursor transcripts of a single gene, plays an important role in generating proteomic diversity. Additionally, alternative splicing is tightly regulated temporally and spatially during development, and aberrant splicing has been implicated in a myriad of human diseases, including cancer and neurodegeneration. An understanding of the molecular basis of splicing regulation may provide insight into therapeutic, preventive, and diagnostic opportunities for many diseases. Most prior research has been unable to analyze splicing in individual cells in vivo. We created fluorescent reporters enabling visualization of alternative splicing events in vivo in the nematode worm Caenorhabditis elegans. These constructs can be used as reporters in mutagenesis screens to identify novel factors that control splicing and as tools to investigate the role of alternative splicing in physiology. We also characterized the function of specific splice variants of the gene unc-62, a transcription factor known to regulate lifespan and contribute to several developmental and behavioral phenomena, including posterior morphogenesis in the embryo and coordinated locomotion. We compared wild type and mutant worms in thrashing and egg-laying assays, and found a specific isoform injected into mutant worms is sufficient to rescue their phenotype, returning them to normal functioning. In vivo studies such as this will be invaluable resources for identifying splicing regulators and studying the physiological and pathological role of alternative splicing.

Project Mentor: John Calarco, Harvard University Center for Systems Biology
Faculty Sponsor: Robin Snyder, Department of Biology
Volumetric Analysis of Cranial Defect for Evaluating Defect Reossification Using Image-J Software and Micro CT Dataset

Rachel Giesey, Presenter, Biology dept. Kaveh Varghai, Researcher Student at CWRU (Beachwood High school), Brendan Alleyne, Grad student, Medical School. Arun Gosain MD. Medical school, Plastic surgery dept.

Purpose: To evaluate 3D volumetric analysis of cranial defect and bone reossification by using Image-J software to compare to linear or two dimensional analyzes.

Background: Bony defects in the craniomaxillofacial skeleton remain a major and challenging health concern. These defects may be congenital or acquired. The cranium plays the main protective role for the brain and therefore, bony defects are functionally debilitating, socially incapacitating, and economically burdensome. Since reossification of cranium defects can be started from distinct points in different layers of cranial bone and because of the curved structure of the cranium, evaluation of reossification is difficult. This paper demonstrates our method of precise measurement of reossification through bone 3D analysis using Image-J (NIH) software.

Methods: The rat cranium CT-dataset was imported to Image-J software. Three dimensional images were examined first, from the coronal view to measure bi-zygomatic distance to eliminate magnification error. Axial planes that included the cranial defect were specified. The image threshold normalized to cranial bone density. Specified axial planes were overlaid and defect size was marked and volumetric measurements were obtained with software tools. This measurement was performed with CT-datasets from post-operation days, 1, 12weeks, and 24weeks to evaluate bone reossification.

Result: Volumetric 3D results were reliable and repeatable and were confirmed with skull gross examination and physical measurements after sacrificing and skull harvesting.

Conclusion: Image-J is free, but powerful image processing software. In this study we showed, capability of Image-J to obtain 3D images using the software tool determined accurate 3D volumetric cranial defect measurements.

Project Mentor: Arun Gosain MD, School of Medicine., Plastic Surgery Department

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Plasmodium falciparum’s Response to an Oscillating Weak Magnetic Field

Rebecca Gilson, Department of Physics

Malaria causes nearly one million deaths per year and Plasmodium falciparum is the most deadly of five types of human malaria. When the malaria parasite infects human red blood cells it consumes hemoglobin, digesting the globin into amino acids used for protein synthesis. The liberated heme is comprised of an iron bound to four nitrogen atoms of the pyrrole ring of protoporphyrin IX. The iron can exist in either the ferrous or the ferric states, which makes the heme toxic to the parasite. The detoxify the heme, the parasite, creates an inert polymer of heme called hemozoin. The iron is forced into its ferric state, making hemozoin paramagnetic. We hypothesized that applying an oscillating magnetic field to hemozoin will cause it to vibrate, which may lead to the death of the parasite, either by: preventing the formation of hemozoin, or destroying the hemozoin after it has already formed. This project seeks to determine the magnetic field strength and frequency that leads to the greatest death of the Plasmodium falciparum parasite in vitro. We have determined that at a frequency of 5 and 10 Hz, the growth of the parasites decreases with stronger magnetic fields. In the future we will continue to determine the optimal frequency and magnetic field that causes the greatest parasite death. Then we will perform a time course to ascertain the specific life stages are being killed by treatment, which will help determine the formation of hemozoin.

Project Mentors: Brian T. Grimberg, Center for Global Health and Disease; Robert Brown, Department of Physics
Assessment of Pilot Scale Biosand Filter Modified with Brass Disinfection Layer

Jennifer Huang, Civil Engineering Department; Maeve Goede, Civil Engineering Department; Henry Spradley, Civil Engineering Department

One fifth of the world’s population depends on untreated drinking water. Inadequate water quality creates higher morbidity and mortality rates in undeveloped and developing countries. Point-of-use (POU) drinking water treatment technology helps people to treat their water at home and to improve the quality. Among the POU technologies, biosand filtration (BSF) has been an effective and low-cost method used for pathogen and particle removal in drinking water purification. The aim of this project is to evaluate the pathogen reduction potential of modified BSF with granulated brass disinfectant layer, to determine if additional disinfection is enabled with granulated brass. Physical and biological tests were conducted to compare the performance of the modified BSF with the conventional BSF for three month duration. The conventional BSF filter was filled with gravel, pea gravel, coarse sand, and fine sand. The modified BSF was constructed in the same manner, with a granulated brass disinfectant layer between fine sands. 2 gallons of water was run for each filter. Test results showed that 90.47% reduction in total coliform, 96.59% reduction in fecal coliform and 91.02% reduction in turbidity for conventional BSF and the 89.32% reduction in total coliform, 68.85% reduction in fecal coliform, and 88.84% reduction in turbidity for modified BSF. Compared to the performance of the conventional BSF, the modified BSF (with brass) has made no significant contributions to the improvement of the quality of water.

Project Mentors: Assistant Professor Banu Sizirici Yildiz, Civil Engineering Department, Assistant Professor Emmit Jolly, Department of Biology

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Increasing Gardasil Vaccination Rates in Fairfax

Gina Guyer, Department of Nursing, Kana Watanabe, Department of Nursing

Data collection surrounding the geographical area of Fairfax Ohio revealed that 98% of the population is African American, 97.8 out of 1,000 females aged 15-19 in Fairfax have given birth, and 23.6% of the population is younger than 18 years of age (NEO CANDO, 2008). These demographics place the Fairfax community at high risk for contracting Human Papillomavirus (HPV). In order to combat the disease, the main goal of this study was to increase the rate of Gardasil vaccinations in the Fairfax community by 5% by August 15, 2011. The random sample population included 100 patients who have been seen in the last twelve months by the pediatric physician Dr. Underwood at Otis Moss Jr. Medical Center, who have been tested for Gonorrhea and Chlamydia, and who are between the ages of 11 to 20. The charts of the randomly sampled patients were manually screened to assess if each patient received Gardasil. An educational intervention in letter format was implemented for the parents of the 74 pediatric patients who did not complete the entire three shot course of the Gardasil vaccine or who did not receive a single dose of Gardasil. The implementation of the educational intervention geared toward parents resulted in four patients out of the 74 receiving a Gardasil vaccination and an overall result of a 5.41% increase in the Gardasil vaccination rate in the Fairfax community. This illustrates that educational interventions for parents are a successful way to increase pediatric vaccination compliance.

Keywords: Human Papillomavirus, Gardasil vaccinations, Fairfax Ohio,

Project Mentor: Jesse Honsky, Department of Nursing
Perfectionism and Mindfulness

Anna Handorf, Department of Psychology

Perfectionism is defined as an individual’s wish for the highest performance combined with critical evaluations of performance (Frost, Marten, Lahart, & Rosenblate, 1990). High levels of perfectionism are common in individuals with various psychological disorders, including social anxiety disorder (Juster et al., 1996; Lundh & Ost, 1996), obsessive-compulsive disorder (Frost & Steketee, 1997), and panic disorder with agoraphobia (Saboonchi, Lundh, & Ost, 1999). Perfectionism is also correlated with high levels of worry (Chang et al., 2007; Stober & Joormann, 2001) and low levels of mindfulness (Perolini, 2012).

Mindfulness involves purposefully attending to the present moment without making judgments (Kabat-Zinn, 1994) and can be learned through meditation and present-moment joy training (Borkovec, 2002). While both meditation and present-moment joy techniques decrease levels of worry (Bishop, 2002; Borkovec, 2002), the techniques have different approaches to increasing present-moment focus. Mindfulness meditation emphasizes the importance of accepting one’s thoughts and emotions, whereas present-moment joy training emphasizes finding joy and intrinsic meaning in everyday tasks. Because mindfulness involves taking a non-judgmental approach and perfectionism involves critical self-evaluation, individuals high in perfectionism may struggle to take a mindful approach to life and to practice meditation. We hypothesize that perfectionism will predict pre-post change in positive and negative affect and anxiety in individuals who learn mindful meditation. More specifically, we predict that higher perfectionism will predict smaller pre-post changes. Furthermore, we hypothesize that perfectionism will not predict changes in pre-post scores in the above states for individuals who undergo present-moment joy training.

Undergraduate psychology students completed questionnaires regarding mood, anxiety, worry and attention, listened to a pre-recorded dialogue that explained either mindful meditation or present-moment joy training, and completed questionnaires again. Results and implications will be discussed.

Project Mentor: Professor Amy Przeworski, Department of Psychology

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Investigating snail-minded, a gene implicated in mesoderm patterning in Drosophila

Ryan Haskins, Department of Biology, Juan Chahda, Department of Biology, Lyndsie Haefke, Department of Biology, Rui Sousa-Neves, Department of Biology, Claudia Mizutani, Department of Biology

When observing organisms of closely related species, variations in body size become apparent. Due to differences in size, particularly during embryonic stages, organisms must rescale positional information within the embryo in order to generate all necessary cell and tissue types. Studies done in Drosophila species have shown rescaling varies between the germ layers, with the mesoderm varying significantly. Differences in mesodermal precursor cells are later corrected during the formation of the syncytial myofibers by varying rates of myoblast fusion. For example, D. simulans and D. sechellia display more mesodermal precursor cells than D. melanogaster and thus have an increased rate of myoblast fusion, resulting in larger syncytium muscle fibers. To identify genes involved in this phenotypic variation in myoblast fusion, we utilized data from a genome wide screening that isolated roughly 500 genes that are least divergent between the sister species D. simulans and D. sechellia, but most divergent from D. melanogaster. CG6520 was selected from 22 candidate genes, chosen based on microarray expression data during myogenesis. In situ hybridization revealed that CG6520 is expressed in the presumptive mesoderm and mesoectoderm, and overlaps the expression domains of snail and single-minded. Thus, we named CG6520 snail-minded. RNAi knockdown of snail-minded resulted in embryos with a normal phenotype and viable adults. Alternative expression knock down methods are being explored. To increase the likelihood of a visible phenotype, we are coupling RNAi knockdown with a gene deficiency. We are also investigating if snail-minded is activated by Dorsal by creating universal and null Dorsal expression.

Project Mentor: Claudia Mizutani, Department of Biology
The global obesity epidemic: Culture, body image and stigma in the developed and the developing world

Christine B. Hoguet, Anthropology/International Studies

My project investigates the global obesity epidemic from a cultural anthropology perspective. Cultural processes that have led to the rise of overweight and obesity throughout the world are explored briefly. The focus then shifts to how different cultural groups in the developed world view obesity in terms of body image and body ideals. Generally, modern Western culture prefers thin bodies, although there is variation among cultural sub-groups. This preference of thin bodies stands in stark contrast to Western culture’s “obesogenic” environment, i.e. an environment that presents individuals with cheap, unhealthful and fatty foods, and sedentary lifestyles. This paradoxical relationship between thin body ideals and populations in which now up to two thirds of individuals are overweight or obese has notable consequences for the obese. They experience negative body image and low self-esteem, among other things. One important issue the overweight and obese are faced with is stigmatization and discrimination on nearly all levels of their lives.

As the developing worlds is rapidly industrializing and adopting Western, obesogenic lifestyles and experiencing exposure to Western media, it appears that in some places where heavier bodies used to be valued they are now being criticized and stigmatized. Case studies are discussed of cultural groups that in the past have appreciated big/heavy bodies, and of groups where celebrating big bodies is still prominent. In general, however, I find the increase in obesity in the developing world is associated with an increase in negative body image and fat stigma.

Further, the rising obesity epidemic and its consequences among children across the world, and their experiences of stigmatization and other consequences are highlighted. Finally, possible solutions and ways to deal with the obesity epidemic in a culturally sensitive way are discussed.

Project mentor: Dr. Lawrence Greksa, Chair of the Anthropology Department

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HIV and STI Rates Rise in Cuyahoga County

Lisa Hoover, School of Nursing; Kristin Hwu, School of Nursing; and Elisabeth Maher, School of Nursing

The Cuyahoga County Board of Health (CCBH) strives to find new methods for controlling and decreasing rates of human immunodeficiency virus (HIV) and other sexually transmitted infections (STIs) in Cuyahoga County. In addition, they wish to increase education as a primary prevention tool and provide screening and treatment. One method is to deliver Title X, government-funded Family Planning Clinic services to the underinsured. Short-term objectives of this study included increasing HIV and STI awareness by offering sexual health literature and direct outreach, supplying information about Title X services available at the CCBH Family Planning Clinic, and identifying a city with rapidly increasing rates of HIV/STIs. Because Lakewood saw a rapid increase in HIV cases between 2006 and 2009, continues to have higher rates of STIs, and may have an increasing number of individuals without health insurance, the city was chosen to receive aggressive marketing for CCBH Family Planning Clinic services. Long-term objectives included increasing the weekly average number of clientele at the Family Planning Clinic from 3.90 (average prior to June 2011) to 4.90 persons, and decreasing HIV and STI rates in both Lakewood and Cuyahoga County. By providing direct HIV, STI, and Family Planning Clinic outreach to 474 individuals during June and July 2011, creating new educational literature, and marketing via informatics, the weekly average number of clientele at the clinic increased from 3.90 to 5.75 persons. This project demonstrates that targeted marketing appears to have a measurable effect on increasing the weekly average number of clientele seen at the clinic. Future steps would include replicating and implementing this method in other at-risk communities.

Project Mentor: Linda Boseman, School of Nursing
Effect of Magnetic Stimulation on Neurite Outgrowth

Whitney J. Huang, Department of Biology, Case Western Reserve University

Two decades ago, the idea of electromagnetism allowed minute electrical currents to be induced within a mass by an external magnetic field. In the past five years, in vivo studies have shown that magnetic stimulation (MS) is a potential therapeutic tool for treating epilepsy in humans although results from clinical trials have proven inconclusive. While half of the subjects’ seizures were terminated, results are still in question due to the heterogeneous population and limited human trials. Therefore a need to return to study the foundation underlying the effects of MS is imperative.

In this study, we first determined the effects of MS with different frequencies (1, 5, and 10 Hz pulses) on the axonal growth of neuronal cells in vitro. Through pulsed MS, an enhancement in neurite outgrowth as well as increases in cell abundance and growth were observed by quantifying the neurite length, branches, and tested cell viability.

To find the optimal intensity for stimulation or suppression of neurite growth we can measure the neurite length and branches of different MS induced frequencies. We next examined the effects of orientation/polarization of the magnetic stimulation on neurites to test whether MS can be used to direct neurites to specific targets. These studies are critical before applying magnetic stimulation to suppress seizure clinically. Ultimately, this research is key to understanding specifically how neurons are influenced by MS and can be applied not only to precise area-specific stimulation of neurites for regrowth but also in the future direction of seizure suppression.

Project Mentor: Dr. Ching-Yi Lin, Department of Neurosciences, Lerner Research Institute, Cleveland Clinic
Faculty Sponsor: Professor Michael Benard, Department of Biology, Case Western Reserve University

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Introducing web-based and phone-based technology to assist in smoking cessation among the youth population of Hong Kong.

Kimberly Hunt, Frances Payne Bolton School of Nursing; Alexa Randazzo, Frances Payne Bolton School of Nursing

Smoking is a prominent problem among the youth population in Hong Kong, as 68.2 percent of smokers in 2010 started smoking before the age of 20 (Tobacco Control Office, 2011). Hong Kong has implemented many resources and services to strive toward their goal of a smoke-free Hong Kong, specifically including a youth quitline for residents ages 12-25. The aim of our project is to develop and introduce resources that are more appealing to these youth smokers. Technology use is very high in Hong Kong, especially among youth residents. Therefore, utilizing technology by creating web and phone-based smoking cessation resources is the best way to target youth smokers. After presenting these ideas to The Youth Quitline at The University of Hong Kong, our methods will then be implemented into their current program and will provide an overall more attractive service.

Project Mentors: Dr. Sophia Chan, University of Hong Kong School of Nursing; Dr. Mary T. Quinn Griffin, Frances Payne Bolton School of Nursing; Dr. Sarah Gueldner, Frances Payne Bolton School of Nursing.

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The Education of National Youth Sports Program Participants on Physical Activity

Maria Innamorato, Frances Payne Bolton School of Nursing; Alaina Shahen, Frances Payne Bolton School of Nursing; Frank Wenner, Frances Payne Bolton School of Nursing

The purpose of this project was to increase the knowledge of adolescents participating in the National Youth Sports Program (NYSP) regarding the benefits of physical activity and the resultant negative outcomes associated with leading a sedentary lifestyle. Based on assessment, observations, and conversations with
residents and health care workers from Cleveland, Ohio, we learned that children living in the city of Cleveland do not meet the required 60 minutes of daily physical activity as recommended by the National Guideline Clearing House (Active healthy living, 2006). Additionally, we have assessed that there is a knowledge deficit in NYSP adolescents regarding physical activity, its benefits, and the risks of overweight and obesity.

Our goal was to achieve a 20% increase in knowledge of physical education. There were 160 adolescents involved in our study. To do this, we developed five different lesson plans and presented them to eight groups of approximately twenty students each. The topics were BMI and calories, cardiac health, sports injuries, muscle groups and stretching, and the negative effects of leading a sedentary lifestyle. We measured an increase in knowledge by administering pretest and post-test surveys before and after each topic.

Due to unexpected circumstances, we could not accurately test on the sedentary lifestyle lesson, and were therefore unable to include the topic in our final results. However, we met our goal on three of the four remaining topics as evidenced by the post survey scores. We misjudged the participants’ prior knowledge about cardiac health, so their pre-survey results for that subject did not mathematically leave enough of a deficit to improve by 20%; however there was still an overall improvement on the subject. This program is a tool that public health nurses can utilize to educate young people about any topic in a comfortable setting.

Project Mentor: Ebony Hardee, Frances Payne Bolton School of Nursing

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What’s on YOUR Plate?
Improving Healthy Food Choices and Nutritional Knowledge at CWRU Squire Valleevue Farm

Emily Jasina, BSN Student Frances Payne Bolton School of Nursing; Jessica Nuhfer, BSN Student Frances Payne Bolton School of Nursing; Erica Pizzolato, BSN Student Frances Payne Bolton School of Nursing; Evalyn Zimpelmann, BSN Student Frances Payne Bolton School of Nursing.

Health screenings have revealed that obesity and elevated blood pressure are an epidemic among the Cleveland Metropolitan School District (CMSD) children. The goal of our project was to implement interventions within one CMSD school with the aim of improving the health status by increasing basic nutritional knowledge and healthy food choices. Research has shown that integrating the school state mandated curriculum with lessons and experiences involving gardening, healthy food production, environmental science and nutrition has the potential to improve health behaviors among children. Using the resources and financial support of the CWRU Squire Valleevue Farm, we scheduled three field trips between October 21 and November 18, 2011 for thirty-three 5th graders at Michael R White Stem School. The field trip lesson plans, modeled after a farm to school program, conceptually and experientially introduced the students to healthy food production, the importance of a sustainable ecosystem, and the importance of good nutrition for life long health. A pre-survey to measure baseline knowledge of healthy food choices and nutrition was administered to the children at the beginning of the first field trip day. A post-survey, identical to the pre-survey, will be administered at the end of the last field trip day. Our goal is to show a 20% increase in knowledge from pre-survey to post-survey and that the integrated lessons will benefit the Squire Valleevue Farm in their efforts to continually educate elementary school children.

Project Mentor: Marcella T. Hovancsek, RN, MSN. FPB School of Nursing

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MRSA Among Gila River Reservation Residents

Shayanna Jones, Department of Nursing; Jaimie Jurkowski, Department of Nursing; Angel Ramos, Department of Nursing; Emily Witte, Department of Nursing

During the summer of 2011, on the Gila River Native American Reservation, many health care workers began to recognize an increase in the prevalence of reported cases of methicillin-resistant
Staphylococcus aureus (MRSA). As a result of this observed increase in the number of MRSA cases, various strategies had been implemented by the health care facilities (or the Indian Health Service) to reduce this number. These were focused on providing information on ways to prevent the spread of MRSA and how to properly treat it once it was diagnosed. Direct education, the use of posters, and other methods were employed. However, as the number of diagnosed cases continued to rise, one had to question why this was happening. It was noted, that despite the fact that information was being presented to the community, the community itself had very little understanding regarding MRSA. Through a search of the literature we came to recognize the key points that would be important for members of the community to understand. It was assessed that reservation members felt that they had been given adequate information regarding MRSA and in turn did not perceive that they had a knowledge deficit that needed to be corrected. An intervention was designed that included a pre/post test and a one-on-one teaching regimen to better address the needs and concerns of the individuals. The target audience of randomly selected adults in the outpatient department of the Gila River Reservation Health Care Corporation was identified. After a brief pre-test, one-on-one education, and a post-test, there was an increase in understanding regarding MRSA and methods to reduce or prevent its transmission through the community.

*Project Mentor: Linda Boseman MSN, Department of Nursing*

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**Oncology Therapeutics: Hyperthermia Using Self-Heating Micro-particles in Conjunction with Pluronic Nanobubbles**

*Carmen Kakish*, Department of Biomedical Engineering; Ananth Iyengar, Department of Mechanical and Aerospace Engineering; Dr. Alexis Abramson, Department of Mechanical and Aerospace Engineering; Dr. Agata Exner, Department of Biomedical Engineering; Luis Solorio, Department of Biomedical Engineering; and Ashlei Beiswenger, Department of Biomedical Engineering

Micro-particles composed of Poly-Lactic-Co-Glycolic Acid (PLGA) coated calcium chloride are being created for the development of an innovative form of cancer treatment. The proposed treatment involves the in situ delivery of the micro-particles into the intracellular space of a cancerous cell. After extended exposure to the intracellular space of the cancerous cell, the PLGA coating of the micro-particles will dissolve allowing for the exothermic reaction of calcium chloride with water. The release of heat from the reaction will raise the temperature of the cell beyond viable means; thus, causing death of the cancerous cell. Baseline tests measuring heat release and temperature change of the dissolution of calcium chloride with water were conducted using the method of calorimetry in order to understand the thermal behavior of particles. Further analysis of these results should give insight into the amount of calcium chloride embedded in the particle. The next step in the research is to test the thermal behavior of various formulas of particles in order to determine the ideal concentration and type of particle for the project to proceed. The addition of Pluronic nanobubbles to the particles is set for a future date. Ideally, Pluronic will suppress the development of the heat-shock proteins of a cell; thus, reducing the cancer cell’s ability to respond to the temperature rise caused by the dissolution of calcium chloride. This will result in more efficient cancer cell death.

*Project Mentor: Dr. Alexis Abramson, Department of Mechanical and Aerospace Engineering*

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**A New Transgenic Model for the Inducible Ablation of Astrocytes**

*Molly Karl*, Department of Anthropology and Department of Chemistry; Dr. Sharyl Fyffe-Maricich, Department of Neurosciences; Dr. Robert Miller, Department of Neurosciences

Astrocytes are an important cell population in the brain with various functions that include extension of their processes to the nodes of Ranvier and the blood brain barrier, specific roles in synaptic functioning and uptake of extracellular glutamate to preserve axon health. Much of the current knowledge of astrocytes is based on *in vitro*
studies which leave much interpretation and assumption about their in vivo functions. In an effort to gain more insight to the endogenous role of astrocytes, we have developed an in vivo transgenic (Tg) model. This model will have the capability of selectively ablating glial fibrillary acidic protein (GFAP)-expressing astrocytes in response to a small molecule called chemical inducer of dimerization (CID). The GFAPiCP9dsRed transgenic mice express an inducible Caspase9 gene (iCP9) under the transcriptional control of the mouse GFAP promoter followed by a dsRed marker to allow visualization of transgene expression. Immunofluorescence analysis of GFAPiCP9dsRed Tg mice revealed that all dsRed+ cells were GFAP+ confirming the specificity of transgene expression. Furthermore, no overlap was seen after labeling dsRed+ cells with antibodies against the neuronal marker NeuN or the oligodendrocyte marker CC1. After confirming specificity of the Transgene we specifically ablated GFAP+ cells in the cerebellum by a direct injection of the CID molecule into 21 day old mice. Within two days of injection the mice exhibited discoordination and gross analysis of the brain revealed a hematoma at the injection site. This poster explores the gross anatomical as well as the histological changes that took place in the Tg mice after ablation of astrocytes.

Project Mentors: Dr. Robert Miller, Department of Neurosciences; Dr. Sharyl Fyffe-Maricich, Department of Neurosciences

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Age Estimation of the Adult Female Skeleton Using the Auricular Surface and the Pubic Symphysis

Molly Karl, Department of Anthropology and Department of Chemistry; Dr. Scott Simpson, Department of Anatomy

The human skeleton has two hundred and six bones which all develop based on their own time tables. These timescales are fairly consistent between the sexes and across biological populations, barring traumatic injury or disease. When aging the adult human skeleton few of these bones can produce reliable and accurate age estimations. Age determination of the human skeleton is a very important process that is used in fields such as paleodemography and forensic science. The most reliable age estimates use multiple anatomical sites to give the most accurate estimation of age, but what if a researcher is only provided with a partial skeleton? The pubic symphysis and the auricular surface of the pelvis are two commonly used joint surfaces that are quite useful in determining an accurate estimation of skeletal age, especially in adults. Using the Hamann-Todd Osteological Collection at the Cleveland Museum of Natural History, I will try to validate the results of others researchers based on skeletal aging using these two joint surfaces. First, I will develop aging standards using a known-age sample of 38 females. Second, I will rank independently the sample using the two joint surfaces of 61 females of unknown age and population affiliation and will attempt to accurately, and blindly, estimate age based on extensive research of both joint surfaces and how they covary with each other and actual age. I hope to be able to replicate the results of others in an effort to further my knowledge of osteology, as well as in an effort to learn more about aging the human skeleton.

Project Mentor: Dr. Scott Simpson, Department of Anatomy

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Clinical Implications of the Locomotion Patterns Between Humans and Apes

Jasmine Khan, Department of Anthropology; Scott Simpson, Department of Anatomy

Humans are uniquely susceptible to injuries, such as patellar dislocations, cruciate ligament injuries, and arthritis in the knee, not shared by the closely related chimpanzees and gorillas. Evolutionary medicine seeks to understand the origins of human disease in a historical and comparative context. Therefore,
comparing bipedal humans to the quadrupedal apes allows for understanding why humans have increased risk of lower limb injuries while closely related species do not. Further, men and women differ in susceptibility to knee injuries due to the differences in lower limb geometry of the pelvis that are due to the obstetric demands of the female pelvis. The focus of this research is to compare and contrast femur and tibia morphology among humans and apes in order to understand how the geometry of the lower limb can lead to the different risk of lower limb injuries between these groups. The study sample included ten chimpanzees (five males, five females), ten gorillas (five males, five females), and twenty humans (ten males, ten females) from the Hamann – Todd Osteological Collection from the Cleveland Museum of Natural History. This sample allowed for comparisons to be made between quadrupedal great apes and bipedal humans. In addition, male and female comparisons were made within each species. Angular, areal, and linear measurements of the proximal and distal tibia, and distal femur were taken to characterize the differences in morphologies that reflect locomotor patterns and the clinical implications of those morphologies. Thus, the transition to bipedality in humans and the consequences of our unique obstetric demands have led to an increased risk of a variety of musculoskeletal injuries not present in our closest living quadrupedal relatives, the African apes.

*Project Mentor: Dr. Scott Simpson, Department of Anatomy*

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**Barriers to siRNA therapeutics: Exploration of safe and effective siRNA delivery vehicles.**

**Joonsoo Kim**, Department of Biology

RNAi (RNA-interference) refers to a cellular process which facilitates gene silencing by delivering double stranded RNA (dsRNA) in eukaryotic cells. The RNAi pathway creates small-interfering RNA (siRNA) from the long dsRNA by an enzyme called Dicer. This siRNA is found to be the potent molecules which have been proven to silence genes in-vivo. Moreover, several studies also have successfully silenced cancer-producing genes such as human papillomavirus, hepatitis B virus, and age-related macular degeneration as well. However, the major barrier to siRNA in a clinical usage lies in its efficacy and safe delivery to a target cells. Moreover, siRNA is known to be susceptible to degradation when delivered naked due to renal filtration, immune systems, and other physiological barriers. Therefore, various researches and major commercial firms studied to develop novel carriers for siRNA that would improve the delivery to desired cells and tissues. My project focuses on the modes and chemicals to improve the delivery of siRNA and the major barriers that must be overcome for the future RNAi therapeutics.

*Project Mentor: Professor Alan Levine, Department of Pharmacology*

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**Comparison of an Immunochromatographic Rapid Test, a Microplate Enzyme Immunoassay and Traditional Culture Methods for Detection of *Campylobacter SPP.* in Outpatient Stool Samples**

**Karen A. Kruzer:** Medical Anthropology/Chemistry

*Campylobacter* is a leading cause of bacterial gastroenteritis, affecting over 2.4 million persons annually. Campylobacteriosis infection is caused by consuming unpasteurized milk, contaminated food or water, or undercooked poultry. Food poisoning caused by *Campylobacter* spp. can be debilitating, resulting in diarrhea with varying severity from loose to bloody stools. An analytical review of recent publications suggests a problem with consistent detection of *Campylobacter*, therefore a comparison of antigen detection approaches versus culture methods needs to be conducted. The objectives were to compare antigen detection methods, to compare sensitivity for recovery of *Campylobacter* using culture versus enzyme immunoassay, and to tabulate incidence of bacterial, parasitic, and viral pathogens. Three diagnostic methods were performed on 100 stool samples collected from outpatients. ProSpecT™ EIA Test and ImmunoCard STAT! CAMPY® enzyme immunoassays detected *Campylobacter* antigens. Traditional culture on *Campylobacter* selective medium and filtration on blood agar was
Campylobacter is a seagull-shaped gram negative bacilli, catalase positive, oxidase positive, hippurate positive, and motile. Disc diffusion susceptibility to nalidixic acid, cephalothin, and erythromycin further identified the species. Antigen detection tests recovered 7 positives, whereas culture methods recovered 3 positives. The gold standard was two-fold. When culture served as reference, sensitivity/specificity were high (both >65%); ImmunoSTAT! positive predictive value was 28%. When positive EIA or culture served as reference, ImmunoSTAT! sensitivity decreased, but positive predictive value increased. The highest incidence of enteric pathogens was Campylobacter and Clostridium difficile. Consistently reliable identification of Campylobacter spp. is crucial for diagnosis of the leading cause of enteritis globally.

**Project Endorser: Geraldine Hall, CWRU School of Medicine, Department of Clinical Pathology**

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**Soil origin affects invasive plant performance.**

S Connor Leahy, Department of Biology; Angela J. Brandt, Department of Biology; Nicole Zimmerman, Department of Biology; Lauren Huffman, Department of Biology; and Jean H. Burns, Department of Biology

Plants are sessile and as such the interactions a plant has with its environment and surrounding neighbors are very important. Due to their nature, plants interactions with the soil surrounding them have important fitness consequences. Nutrients and moisture are absorbed from the soil and many plants also affect the bacterial populations near where they are growing. Local bacterial populations can provide beneficial help to the local resident plant species while in turn causing negative effects for other species of plants that have germinated nearby. This means that plants that are invading areas can come into contact with soil that has been altered by resident species and have their productivity affected by this soil.

Four congeneric pairs of species were used to test how the soil origin affected the resident plants' growth and development. The species studied, Plantago lanceolata, Plantago major, Rumex crispus, Rumex obtusifolius, Solanum carolinense, Solanum dulcamara, Trifolium pratense, and Trifolium repens, were all planted in both soil that originated from field populations of the same species or field populations of their congeneric pair. We measured final plant biomass as a fitness surrogate. There were soil and species-specific responses to soil treatments: some being more productive in away soil while others produced more biomass in home soil.

**Mentor: Jean H. Burns, Department of Biology**

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**FGFR2 and AXL Activation in Human Osteosarcoma Cell Lines**

Mee Jee Lee, Department of Biology

This study determined different activity levels of tyrosine-phosphorylated FGFR2 and tyrosine-phosphorylated AXL and whether overexpression of FGFR2 and AXL causes their activation in human osteosarcoma cell lines by using phospho-ELISA(Enzyme Linked Immunosorbent Assay) and total-ELISA methods. The results showed that both FGFR2 and AXL were most activated in highly tumorigenic or metastatic cell line in each family: MNNG cells in TE85 family and LM7 cells in SAOS family. However, the level of expression of FGFR2 and AXL did not correlate with the level of activity, thus suggesting that overexpression does not necessarily cause the activation of receptor tyrosine kinase(RTK)s in human osteosarcoma cell lines. This study calls for other possible mechanisms responsible for activation of RTKs such as mutations, chromosomal translocations, or ligand production.

**Project Mentor: Dr. Edward Greenfield, Department of Orthopaedics**
Intersections: Symposium and Poster Session
of Symptoms in Children with Autism Spectrum Disorders

Maria Lemler, Department of Cognitive Science

The Center for Disease Control and Prevention defines Autism Spectrum Disorders (ASD) as a pervasive developmental disability in which individuals have language impairment, social impairment and stereotyped behaviors. At this time, there are no required assessments for a diagnosis. Diagnosis is often made with overreliance on parent report of symptoms. The purpose of this research is to examine the consistencies between parent report and clinician observation of symptoms using the commonly used measures to diagnose ASD (ADOS & ADI-R). Previous research has shown diagnosis is more reliable and valid when using both ADOS (clinician observation) and ADI-R (parent interview). It is hypothesized that parents will score their children as less affected in the subdomains of social deficits and communication and more affected on restricted interests than clinicians. This discrepancy is expected based on the unique relationship between parents their children and the resulting difference in social interactions and communication parents have with their children compared with someone with whom the children are less close. This research included 12 individuals diagnosed with an ASD by a professional who were between the ages of 9 to 22 years old (mean age = 15.8). Results from the present study indicate whether differences exist between parent and clinician reported information, such results are crucial as they can help determine how different sources should be considered during the process of diagnosis and creating treatment plans for individuals with ASD.

Project Mentor: Dr. Anastasia Dimitropoulos, Department of Psychological Sciences
OCTivat: Optical Coherence Tomography Image Visualization and Analysis Toolkit

George C. Linderman¹, Zhao Wang¹, Hiram G. Bezerra², Marco A. Costa², Andrew M. Rollins¹

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Introduction
Coronary artery disease is the leading cause of death in the world today. Intravascular Optical Coherence Tomography (OCT) is a high resolution (<15µm) imaging modality that allows physicians to quantitatively identify key features related to coronary artery disease, such as thin cap fibroatheroma (TCFA) and calcified plaques. Currently, the only commercial software (LightLab/St. Jude Medical Inc.) has limited capacity for quantitative diagnosis and does not have an interactive 3D visualization of these images. Additionally, image analysts have to spend hours manually segmenting and analyzing each of the cross-sections for the physician to make a diagnosis.

Methods & Results
We have developed the Optical Coherence Tomography Image Visualization and Analysis Toolkit (OCTivat) to be the complete solution for analysis and visualization of intravascular OCT images. OCTivat leverages popular analysis and visualization libraries and is built for speed and extendibility, so that future researchers can continue development and incorporate additional features and algorithms. OCTivat’s interface is depicted in the figure below. Users can perform automated lumen segmentation, semi-automated TCFA segmentation, manually correct contours, and perform various types of quantification. OCTivat also facilitates visualization with a variable-axis longitudinal view, interactive reference frame, window/level controls, and interactive 3D volume rendering using composite ray casting.

Figure - Left: OCTivat 2D mode (left), 3D flythrough-view (upper right), 3D longitudinal-view (lower right) of an intravascular OCT image of a patient’s coronary artery 15 months after stent placement.

Conclusion
OCTivat implements robust algorithms for intravascular OCT image analysis and visualization with unprecedented speed and accuracy. Using OCTivat’s automated analyses and visualization, physicians and researchers will be able to quantitatively diagnose coronary artery disease while saving time and reducing inter-observer bias.

Project Mentor: Professor Andrew Rollins, Department of Biomedical Engineering
Health Education through Exercise and Nutrition in Children of High-risk, Low-income families:
Southeast, Alaska

Eduardo Locci, Frances Payne Bolton School of Nursing

Southeast Alaska is home to many indigenous people who still attempt to continue their historical way of subsistence living. The small size and inaccessibility of these parts of Alaska poses limitations to conventional means for health education. Often the question is asked: “How can encourage these high-risk families to participate in health education?” One way is to bring health education to them. The purpose of this project was to work and build a relationship with the Southeast Regional Resource Center agency, The Learning Connection (TLC), which is an after school program for children in kindergarten to 5th grade. One of the well-known problems in Southeast Alaska is obesity in adults. In 2010, 65% of adults in Alaska were overweight or obese and children’s statistics were rapidly increasing. The rates are even higher in low-income housing areas where most families live in trailer parks and there is very minimal playground space for the children to enjoy. My goal was to develop a program about nutrition and exercise incorporating new strategies such as dance to improve these statistics and use the space available in the most efficient way.

The first step was to identify barriers to bringing practical health education to Southeast Alaska’s doorstep. My objective was to develop and implement a three course program incorporating new routines to commonly known children’s exercise games. Evaluation of the program was completed by self and public observation as well as pretest and post-tests for the children of about 10 questions on nutrition and exercise. Results showed that the children that were in attendance for multiple classes increased their scores by about 15%. The evaluation helped me identify culturally appropriate strategies that felt comfortable for all parties. Introducing these new techniques encouraged the caregivers at the afterschool program to try new activities that the children could bring home to their family members. I was impressed and very proud on how fast the participation increased from five students to fifteen as they all realized that these new exercise routines were fun. The Learning Connection staff and the Public Health Nurses for Southeast Alaska are now dedicated to this program.

Project Mentor: Mary T. Quinn Griffin, Frances Payne Bolton School of Nursing

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eSMART-HD Exit Interviews

Allison Luoma, Department of Nursing

Open communication between patients and providers is important in assuring that a healthcare visit produces good health outcomes. Our computer simulation, eSMART-HD (Electronic Self-Management Resource Training to reduce Health Disparities), was designed to teach patients skills they need in order to better communicate with their healthcare providers. Exit interviews, both focus-group and individual, were held to understand the effectiveness of the simulation. Participants that had attended six sessions were interviewed. We asked participants to explain their experiences with the study. Through a systematic coding procedure, we analyzed the data, and four themes emerged: health systems, visit, take aways, and future directions. Participants’ shared their views of the healthcare system in general, such as provider characteristics, access to healthcare, and quality of healthcare. We learned what parts of eSMART-HD worked well, for example the ease of use, the touch screen, the staff interface, and getting their blood pressure checked once per month. On the other hand, we learned what did not work, including disconnect between the staff and the computer system, the repetition of both the simulation and the questionnaire, and issues with social desirability. Participants showed they have become better advocates for their health, learned to pre-reflect before doctor visits, learned how to speak to their providers in a structured way (Share your Story, Bring your Background, Ask questions, Review the plan, decide if it is Right for you, and Repeat the plan), and some even told us that their experience was life-changing. These are just a few examples of the many take aways described to us by our participants. They, also, gave us insight on how to best implement eSMART-HD in the future, such as where it would be most useful.

Project Mentor: Lisaann Gittner, Department of Nursing
Adult Health Clinic Program Improvement

Colin Lux, Frances Payne Bolton School of Nursing; and Cecilia Rakes, Frances Payne Bolton School of Nursing

The Adult Health Clinic is a clinic run by the Lorain County Health Department. Currently the main focus at the clinic is disease management. The goal of this project is to help the clinic move from disease management to disease prevention. To move to disease prevention, a preventative screening tool was created along with other useful tools. This preventative screening tool includes tests recommended by National Guideline Clearinghouse, American Cancer Society, and US Department of Health and Human Services for older adults (aged 55 +). The tool also includes screening tests that are routinely performed at the Adult Health Clinic. To test the preventative screening tool, 58 clients were asked about their medical history. A total of 42 females and 16 males participated in the study. Once the surveys were completed, data was analyzed. Data showed that clients had the greatest compliance with recommendations when the screening test was performed at the Adult Health Clinic. In general, the tests that had the lowest compliance were tests that could not be performed at the clinic. The knowledge gained from the screening tool will help the clinic focus on the necessary preventative testing to improve the health of the clients at the Adult Health Clinic.

Project Mentor: Dr. Lynn Lotas, Frances Payne Bolton School of Nursing

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Improving the Education of New Mothers

Kailey MacIsaac, Nursing; Miranda Pifferetti, Nursing

During the summer semester of 2011 we completed our capstone experience at Great Lakes Home Health Care and Hospice in Erie, Pennsylvania. We split our time between four different areas of nursing which were: wound care, postpartum mom/baby visits, generalized medical-surgical nursing, and hospice care. During the first few weeks of our experience we observed that many of the new mothers who were receiving home health visits from our agency had a knowledge deficit in personal and infant care topics. We also noted that Great Lakes did not provide any pertinent literature to this specific group of patients. We felt that an information packet could be used to reduce the knowledge deficit of new mothers in the community. We interviewed the mom/baby nurses at our agency as well as new mothers within the community to determine what topics they felt were the largest areas of concern within most of the women in the community. We then compiled information from multiple sources into a colorful packet of information geared specifically toward new mothers and distributed them to the mom/baby nurses at our agency to provide to their patients.

Project Mentor: Marilyn Lotas, Frances Payne Bolton School of Nursing

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Promoting Safe Sex Practices in St. Thomas, United States Virgin Islands

Jillian Majka, Frances Payne Bolton School of Nursing; Nikki Taylor, Frances Payne Bolton School of Nursing

According to the HIV Surveillance 2010 Annual Data Report published by the Virgin Islands Department of Health, the cumulative rate of those infected with HIV (Human Immunodeficiency Virus) in the Virgin Islands is second in the nation. The Virgin Islands ranks #1 in the nation for rates of Chlamydia and #5 for prevalence of Gonorrhea. In 2010, there were 296 reported cases of HIV in the Virgin Islands. There were 632 reported cases of AIDS. There were 615 reported cases of Chlamydia and 136 cases of Gonorrhea. Since the 1990’s there has been a steady increase in the cases of Sexually Transmitted Diseases (STDs) and HIV in the territory. Our
main objective during our capstone experience in St. Thomas, United States Virgin Islands was to provide sexual health education of young adults to increase the awareness of risky behavior and promotion of safe sex practices.

We provided a 10-week educational program across a variety of settings including public high school classrooms, family planning clinics, and various outreach venues such as the University of the Virgin Islands. Educational topics of the course curriculum include healthy relationships, safer sex, birth control methods, STD awareness and prevention techniques, and local resources. Education methods include verbal instruction, demonstration, interactive games, brochures, and posters. In order to evaluate the effectiveness of our instruction, we developed a comprehensive test which was administered at the beginning and end of our educational program. At the end of the program on awareness of risky behavior and promotion of safe sex practices, it is expected that participating adolescents and young adults will obtain a 15% increase on the post-test exam scores.

The course curriculum we created was well-received by Family and Consumer Science department faculty members and school administrators. In the upcoming trimester, our lesson plans and Powerpoints will be incorporated into the Family Relations/Child Care class at one of the schools.

Project Mentor: Dr. Sarah Gueldner, Frances Payne Bolton School of Nursing

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Is positive affect a possible predictor of future coping with depression

Allen Mallory, Psychology Department; Susan Klostermann, Department of Psychology. Abby Hughes-Scalise, Department of Psychology; Emily Patton, Department of Psychology; Meral Tubi, Department of Psychology; Brittany Laventy, Department of Psychology; Scott Tillem, Department of Psychology; Talla Azem, Department of Psychology; Ceylan Atesoglu, Department of Psychology

It has been suggested, that sufficient use of positive affect while experiencing a stressful situation may improve an individual’s ability to successfully regulate their emotion. Little research has been done on the interaction of parent-teen dyads and emotional regulation. Respiratory sinus arrhythmia (RSA) has been connected with measuring emotional regulation. This study looked at 61 parent-teen dyad’s (age 11-17 years) RSA during a paced breathing task, time spent in mutual affect during a discussion task, and changes in depressive symptoms in a three month follow up after the lab visit. More time spent in mutual positive affect during the discussion task was found to predict lower depressive symptoms in non-depressed teens at the three month follow up but higher depressive symptoms in depressed teens. Also, RSA (related to better emotional regulation) was found to moderate the relationship between mutual positive affect and depressive symptoms. Results suggest that lower RSA and more dyadic mutual positive affect predict decreased depressive symptoms in non-depressed teens over time.

Project Mentor: Dr. Arin Connell, Department of Psychology

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Peritraumatic and Trait Dissociation Among Individuals with Posttraumatic Stress Disorder and Varied Histories of Childhood Sexual Abuse

Gloria McCann, Department of Psychological Sciences

The lifetime prevalence of childhood sexual abuse (CSA) in the U.S. is estimated to be at least 20% among women and up to 10% among men (Finkelhor, 1994). While many who experience CSA are resilient, studies do show high rates of posttraumatic stress disorder (PTSD) in this group (Nishith, Mechanic, & Resick, 2000) and dissociation (Briere & Runtz, 1988). Some conceptualize dissociation, which is characterized by feelings of detachment or altered awareness from the present state, as a coping strategy used by individuals suffering from PTSD. It has also been proposed to be somewhat uniquely associated with CSA (Gibson & Leitenberg, 2000; Merrill, Thomsen, Sinclair, Gold, Milner, 2001). The present study will examine whether dissociative symptoms
Intersections: Symposium and Poster Session

occur more commonly among individuals with PTSD and a history of CSA, as opposed to those with PTSD and no history of CSA. We hypothesize that those with a CSA history compared to those without such a history will endorse higher levels of both trait dissociation and peritraumatic dissociation. In this study, two hundred men and women with varied trauma histories and chronic PTSD completed self-report measures of trauma history and trait and peritraumatic dissociative symptoms. Nearly one third (n = 72, 36.5%) of the sample reported CSA history. A history of CSA was not significantly associated with higher levels of trait dissociation and peritraumatic dissociation. As predicted, those with CSA history scored significantly higher in some subtypes of dissociation. It remains unclear if dissociation is directly related to a history of CSA, however, these findings may have important implications toward understanding the psychological sequelae of childhood sexual abuse.

References

Project Mentor: Professor Norah Feeny, Department of Psychological Sciences

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Vitamin D Insufficiency and Deficiency: Targeting the Otis Moss Jr. Health Center in the Fairfax Community

Sarah Milligan Frances Payne Bolton School of Nursing; Jazmin Townes Frances Payne Bolton School of Nursing, /University of the Virgin Islands; Nailah Williams Frances Payne Bolton School of Nursing, /University of the Virgin Islands

The Otis Moss Junior Health Center, Cleveland, OH, provides quality health care in a spiritual supportive environment. Based on subjective and objective data that we gathered from health care staff members working in the facility, 54% of pediatric patients, ages 1-5 years, are lacking Vitamin D. We felt this insufficiency/deficiency was a growing concern within the clinic. To address this problem, our goal was to bring awareness and provide education to the parents that seek care for their child at the Center. We developed and administered a pre and post-test survey to 20 parents over a two-month period to assess their knowledge and note the amount of Vitamin D their child was being exposed to. In our initial survey, only one parent answered all questions correctly—indicating there was a large knowledge deficit. The pre survey results also indicated that children were not being exposed to very much sunlight or nutritional sources of Vitamin D. To increase knowledge, we conducted one on one educational sessions and distributed educational handouts to parents. The results of our post-test survey showed an 18% increase in knowledge. Other interventions that we performed included, constructing and mounting posters in the waiting and examinations rooms with nutritional choices that contain Vitamin D, facts on the importance of sunlight exposure and the consequences of Vitamin D insufficient/deficiency. Also, we mailed out letters to the parents of those patients whose current Vitamin D levels were lower than 30 ng/mL. Overall we have successfully increased awareness and knowledge related to Vitamin D within the center. Our interventions will continue to be used at the Otis Moss Center.

Project Mentor: Ebony Hardee, Department of Nursing
Expressive Language Differences among Children Diagnosed with Developmental Disorders

Alair Newman, Department of Psychology; Rachael Cooper, Department of Psychology; Maia Noeder, Department of Psychology; Tricia McCutchan, Department of Psychology

Expressive language refers to the ability to articulate ideas through word formation, and includes the rules of syntax and grammar. Differences in expressive language abilities have been observed in children with various learning and attention disorders, with these skills predictive of academic success (Short et. al, 2011). In this study, the Systematic Analysis of Language Transcripts (SALT) guidelines were used to transcribe speech samples taken from 61 participants aged 4-7 (male=41, female=20). The participants had been diagnosed with either a Autism Spectrum Disorder(ASD=13), Specific Language Impairment(SLI=8), Attention Deficit Hyperactivity Disorder(ADHD=13), combined ADHD/SLI(N=8), or none(Typical=19). SALT analyses were performed on transcripts obtained in two unique settings (free speech with examiner & independent child play), in an effort to evaluate performance differences in our groups. In both settings, children in the typical group were more talkative than children in any of the other groups, with children in the ASD and SLI groups being the least talkative. Some setting effects were noted for children diagnosed with ASD. As predicted, children in the ASD groups displayed an increase in expressive language skills during the structured examiner interview as compared to the independent play assessment. Evaluation of informal language samples may provide clinicians with a more precise diagnostic tool for identification and treatment of weaknesses in expressive language development across a variety of social settings.

Project Mentor: Professor Elizabeth Short, Department of Psychology

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The Effect of Procaine Injections in the Central Complex on Cockroach Behavior

Claudia Nieuwoudt, Department of Biology; Alan J Pollack, Department of Biology; Nick D Kathman, Department of Biology; and Roy E Ritzmann, Department of Biology

Our lab has studied the influence of a group of midline brain neuropil structures – the Central Complex (CC) – on neural activity and locomotor function in the cockroach. Previous research characterized cellular units in these structures via multi-channel recording in restrained and tethered preparations (Ritzmann et. al, 2008; Bender et. al, 2010). We now desire to extend this characterization via locomotor behavioral assays that would include time-dependent reversible blockage of activity in CC neurons. This can be accomplished with procaine, a sodium channel blocker commonly used as a local anesthetic that, when injected in the CC, likely prevents neurons from firing action potentials. The procaine effects fade after 30 to 60 minutes. One of the challenges in developing a procedure performed on the cockroach CC is the damage due to surgical techniques. This makes associating regions of the CC with behavioral effects uncertain, as behavioral changes may be due to general surgical procedures, which also may be temporary, instead of chemical injections alone. Our research developed an experimental procedure that minimizes the effects of surgical damage. After an extensive series of procedural modifications, we outlined a surgical procedure for picoinjections in the CC that incurs minimal damage. Identification of pressure injection sites is also critical to characterizing the CC vs. non-CC effects. Earlier studies used rapidly diffusing vital stains that could not be histologically traced. This series of experiments adopted a large molecule fixable fluorescent marker, dextran-fluorescein that has a very slow diffusion rate. We have successfully injected a saline and dextran-fluorescein solution in 3 animals that experienced no visible behavioral changes after surgery. We have also injected a 20% procaine with dextran-fluorescein solution in 6 animals and obtained distinguishable behavioral changes.

Project Mentor: Dr. Roy E Ritzmann, Department of Biology
Interaction between natural selection and sexual selection in the origin of species

Miguel Xavier Nieves, Physical Anthropology, Cognitive Science, Evolutionary Biology

The origin of new species is one of the most compelling questions in science. Cichlid fishes have served as a model system for studying speciation because of their diverse adaptive radiations. A leading hypothesis states that species evolve when natural selection drives diversification, and then a sexually selected preference for the novel traits causes reproductive isolation. I tested this idea using *Herichthys minckleyi*, a cichlid species that recently evolved in an isolated desert valley in northern Mexico. Through natural selection this species has evolved a jaw polymorphism that is not found in closely related species. Through sexual selection it has evolved the ability to change color. *Herichthys* species typically exhibit monogamous mating systems and sexual monochromatism, but *H. minckleyi* has a polygamous mating system and is dichromatic, with females turning white and males turning black when mating. I recorded body color and feeding activity from videos of tagged wild *H. minckleyi* of known jaw morphology. I compared jaw morphology, body color, and feeding activity and found jaw morphology and body color not to be associated. Similarly, body color was not associated with feeding activity. These results indicate that natural selection and sexual selection occurred independently, calling for a re-consideration of current theory on the origin of species.

*Project Mentor: Ronald Oldfield, Department of Biology*

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Using ultrasound imaging to predict drug release from in situ forming implants

Alexander M. Olear1, Biomedical Engineering; Luis Solorio1, Haoyan Zhou1, Ashlei C. Beiswenger1, and Agata A. Exner2. Department of Biomedical Engineering1 and Radiology2

Recent studies have shown diagnostic ultrasound to be an effective method for characterizing phase inversion and predicting initial drug release from in situ forming implants. To further validate this strategy, this study investigated the relationship of phase inversion and drug release with three drugs of various properties. Sodium fluorescein, 1, 1’-dioctadecyl-3, 3, 3’, 3’-tetramethylindocarbocyanine perchlorate (DiI), Bovine Serum Albumin (BSA) and Doxorubicin were investigated as model drugs from Poly (DL-lactide-co-glycolide)/ N-methyl pyrrolidinone polymer systems. They were individually evaluated in studies measuring in vitro dissolution, in vitro ultrasound imaging, pH, scanning electron microscope imaging and in vivo analysis. Doxorubicin and fluorescein released a similar drug mass for a 10 d period, DiI released less than 3% over 14 days, while BSA appeared to delay release caused by polymer degradation. Nonlinear mathematical fitting was used to correlate drug release and phase inversion (R² > 0.93 all formulations). Fluorescein was shown to be a good predictor for doxorubicin drug release; but due to differences in the matrix/drug interactions, phase inversion was markedly different. The hydrophobic DiI was not readily released and increased hydrophobicity of the implant. The observed delay in polymer degradation by BSA was attributed to its buffering capacity at pH 3.5, thus reducing the mass of drug released from the implant. Since the mass release from the implants can be correlated to the rate of phase inversion, the image data provides a means to evaluate implants noninvasively, providing insight into in vivo implant behavior.

*Project Mentor: Prof. Agata Exner, Radiology*

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Genes and Environment: How Do Activity, Density, and Diet Affect Tadpole Oral Morphology?

Catherine Osborn, Department of Biology

An organism’s expression of traits is the product of the genes that they carry and the environment in which they live. Many organisms, including amphibians, exhibit high levels of phenotypic plasticity —
the ability to change its phenotype in response to environmental factors such as predator presence or population density. While many studies have investigated phenotypic plasticity of behavior or tail shape in larval amphibians, little work has examined the plasticity of oral morphology in response to different environments. This research explores the effects of short-term diet, activity level, and population density on the oral morphology of wood frog (*Rana sylvatica*) tadpoles. Specimens were raised for one week in three possible dietary treatments: 1) oak/maple leaf liter, 2) zooplankton, and 3) oak/maple leaves and zooplankton as food. These treatments were cross-factoried against activity level — which has a genetic basis — and two different tadpole densities. I analyzed the tadpole specimens to assess changes in size and oral morphology among the treatment groups. Tadpoles reared in high-density environments were found to be smaller than tadpoles reared in low-density environments. Contrary to previous research, high-activity tadpoles were smaller than low-activity tadpoles. Independent of size, tadpole density had a significant effect on beak depth and tadpole activity had a significant effect on tooth row length. Such research is important in understanding how an organism’s genes and environment affect foraging structures that may alter their growth and development.

*Project Mentor: Professor Michael Benard, Department of Biology*

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**Patient - Physician Communication**

**Nikita Patel**, Chemistry B.A., Psychology B.A.

For the SAGES capstone experience, a literature review was written. In this literature review communication between patient and physician was analyzed. More specifically it related to communication and how it affects patient outcomes. In order to write this literature review, the first step was to look through the “Communication & Mass Media Complete” database. Initially about 25-30 articles relating to patient and physician interaction were found. The review looked at certain age groups (e.g., older adults) and diagnoses such as cancer or chronic diseases, and analyzed differences associated to these groups. Along with finding communication patterns related with negative health outcomes, the paper discussed recommendations that might address some of the problems by describing how adjustment to communication can positively affect patient outcomes. By looking at various articles such as those examining patient narratives, it was found that patient-physician communication influences patients’ health. For example, symptoms a patient exhibits can worsen if the patient chooses not to communicate because he/she is intimidated by a physician. The patients’ viewpoints gave insight on their experiences in the doctor’s office, how they were treated, and the way they recovered. Overall, this literature review was to capture how communication affects patient outcomes such as their overall health, symptoms, or wellbeing and what can be done to improve these problems.

*Project Mentor: Dr. Kathryn Rothenberg, Department of Psychological Sciences, Program of Communication Sciences*

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**FreshLink Social Marketing Toolkit and Recipe Book**

**Rachel Paul**, Department of Nutrition

Current research associates the dramatically increased overweight and obesity rates in America as risk factors for chronic diseases, such as heart disease and Type 2 Diabetes Mellitus. One main contributor to these increased rates is the food environment, where people make food consumption decisions, such as the community, work place, and home. In the past four decades, our society’s food environment has become “obesogenic: characterized by environments that promote increased food intake, non-healthful foods, and physical inactivity.” Many urban areas such as Cleveland, Ohio exemplify this obesogenic environment with limited access to nutritious foods. FreshLink, the Core Research Project of the Prevention Research Center for Healthy...
Neighborhoods at Case Western Reserve University, aims to promote good health and prevent disease among urban residents by providing better access to healthy foods. The Core Project implements healthy food programs in each of four intervention neighborhoods by increasing healthy food availability, nutrition education, and marketing and branding strategies for promoting healthy foods. This Social Marketing Toolkit (SMT) provides evidence-based guiding practices for FreshLink to effectively convey information to neighborhood residents about a healthy diet and positive changes in their food environment (nutritious foods now available to them). It relies on the principles set by Social Marketing, which “seeks to influence social behaviors not to benefit the marketer, but to benefit the target audience […] through ideas, attitudes, and behaviors, instead of just products.” FreshLink’s Social Marketing Toolkit details the “8 Ps” of marketing: publics, product, purse strings, policy, partnerships, price, place, and promotion, each relating to how market healthy food practices and behaviors in urban Cleveland neighborhoods. Sample promotional and branding material is included as well, such as a FreshLink Recipe Book, which has been critiqued and reviewed by select community members for accuracy and cultural relevancy.

Project Mentor: Professor Jessica Kelley-Moore, PhD, Department of Sociology
FreshLink Project Coordinator: Tanisha Tate, MPH, PhD Candidate, Department of Sociology

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WMC Predicts Changes in the Viewing of Emotional Slides Over Time

Michael Petrie, Department of Psychology; Joseph Weaver, Department of Psychology; Heath Demaree, Department of Psychology.

Working memory capacity (WMC) has been implicated as an important factor in both emotional reappraisal and suppression. In the current study, we examined the role of WMC in a different form of antecedent-focused regulation strategy: selective attention. 70 undergraduates participated in session one and 55 returned for session two. Participants completed several questionnaires that assessed self-esteem, positive and negative affect, behavioral activation and inhibition, and use of emotion regulation strategies. They also completed a measure of WMC and viewed positively and negatively valenced images in an eye-tracking task. Half of the participants received negative feedback following a bogus personality inventory during the second session. Comparing session 1 and session 2 data, we hypothesized that WMC would predict the change in the amount of time individuals attended to positive and negative images when they were seen for the first time. Results revealed that WMC did not predict the amount of time an individual spent looking at positive images for the first time but it did predict the amount of time an individual spent attending to negative images for the first time. Specifically, individuals with high WMC spent less time looking at negative images in session 2.

Professor Heath Demaree, Department of Psychology

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Mode Content and Transmission Measurements on Components of the ECH Transmission Lines on DIII-D

Andrew Richenderfer, Department of Physics, M. Cengher, J. Lohr and C.P. Moeller, General Atomics

On the DIII-D ECH system about 25% of the generated rf power is lost in the 90 m long transmission lines, including, typically, 4% at the coupling mirror and 2% intrinsic loss in the straight waveguide sections. The main sources of loss are the ~10 miter bends per line, where Ohmic loss contributes about 0.3% per miter and over 1% addition loss per miter comes from mode conversion due to diffraction. The footprint of the rf beam at the miter mirror, hence the diffraction, can be reduced by combining waveguide modes with power ratios and phase differences such that the resultant wall electric field is close to zero. Such modes can be generated in a tapered input arm. The taper design assumes a perfect HE 1,1 mode propagating into the miter, but in high power tests, the miter
losses actually increased, leading to the hypothesis that the high power beam contained other than a pure HE 1,1 mode. Tests of these miters and of their sensitivity to unwanted modes will be presented.

Project Mentor: Professor Xuan Gao, Department of Physics

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Interventions for Middle School Children Struggling with Obesity

Kaitlyn Roudebush, BSN Student, FPB School of Nursing; Ethan Smith, BSN Student, FPB School of Nursing

Obesity in children has tripled over the past 30 years in the United States. In Cleveland, forty percent of 5th grade school children are overweight or obese. The overall goal of this study is to design a behavioral intervention that can reduce obesity and improve health habits of middle school students. Our objective was to determine if different genders have different attitudes and beliefs on healthy living. Eight focus groups, four sessions for girls and four sessions for boys were held. Data transcribed from notes, drawings, and audio recordings of the focus groups were analyzed to find common themes, words and ideas. In conclusion, the focus group data showed healthy living is perceived differently by boys and girls.

The majority of Girls:
- Felt the healthiest when they were younger because they were thinner.
- Wanted to lose weight.
- Felt motivated when they were on a team, training for an event, or had someone to be active with.

The majority of Boys:
- Felt the healthiest when they were involved in an organized sport and/or tried new fruits and vegetables.
- Placed a strong emphasis on both muscle and bone strength.
- Felt motivated by role models, performance goals, and personal outlets.

The participants wanted learning materials that were active and engaging instead of school-like activities. The original SystemCHANGE intervention materials created for adults were too complex for the middle school students. We refined existing intervention materials by incorporating gender specific key themes and suggestions, to make learning more engaging, and age and culturally appropriate.

Project Mentor: Shirley Moore, PhD, RN, FAAN, Principal Investigator; Jacqueline Charvat, MS, Project Director

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Assessment of Pilot Scale Biosand Filter Modified With Zero Valent Iron Disinfection Layer

Ajmeeta Sangtani, Biomedical Engineering Department; Anna Droz, Department of Biology; Emma Cotter, Civil Engineering Department

Current estimates indicate that nearly one billion people lack access to safe water, all of whom are at serious risk for waterborne diseases. Point-of-use (POU) drinking water treatment technology enables those people who have not access to safe drinking water to treat their water at home and to improve the water quality. Among the different POU technologies, biosand filters (BSF) has been used widely as an efficient, inexpensive, and appropriate technology for removing microbial hazards in developing countries. The objective of this project is to evaluate the pathogen reduction potential of modified BSF with zero valent iron (ZVI) disinfectant layer, to determine whether additional disinfection is enabled with ZVI. The conventional BSF was designed with layers of stone, pea gravel, coarse sand and fine sand. The modified BSF was designed in the same manner with ZVI disinfection layer between fine sands. The filters were run intermittently twice a day with 2 gallons of water collected from the Doan Brook Stream in Cleveland, OH. Water samples were collected from each filter and tested. Test results showed that 93.28% reduction in total coliform, 96.59% reduction in fecal coliform and 91.02% reduction in turbidity for conventional BSF and
the 97.13% reduction in total coliform, 99.9% reduction in fecal coliform, and 93.67% reduction in turbidity for modified BSF. Based on the results, modified BSF filter with ZVI has showed significant improvement in terms of pathogen and particle removal.

**Project Mentors: Assistant Professor Banu Sizirici Yildiz, Civil Engineering Department, Assistant Professor Emmit Jolly, Department of Biology**

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**The Contribution of HPG axis-hormones and hormone replacement timing on cognition associated signaling.**

Jesal Shah¹, Jaewon Chang², Russell Palm², Hyun Jin-Kim², Denise Hatala², Gemma Casadesus Smith²

1 Department of Biology
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Many women experiencing menopause show cognitive function deficits and have increased risk of developing Alzheimer’s disease. While estrogen has been shown to improve cognition and improve molecular signaling associated with learning and memory, these effects are lost if estrogen replacement is not started within a critical time period, close to menopause onset. During menopause the ovaries no longer produce estrogen thus, the negative feedback of estrogen onto gonadotropin production is lost and gonadotropins such as LH increase substantially. This research will answer whether the inability of estrogen to improve learning and memory and associated signaling cascades when estrogen is given after a long interval from menopause onset is due to an estrogen-dependent mechanism, or simply because of its inability to effectively down-regulate LH. The goal of this project is to study the changes in the signaling proteins important for learning and memory, such as CaM Kinase II phosphorylation, GluR1 phosphorylation, as well as changes in levels and phosphorylation state of synaptophysin, after ovariectomy and how downregulation of LH or supplementation of estrogen modulate these compared to controls (SHAM operated mice). Further we seek to determine whether interval between menopause (ovx) and treatment onset has an impact on these cascades and whether downregulation of LH or estrogen modulate these differently depending on the timing of treatment.

**Project Mentor: Dr. Gemma Casadesus, Department of Neurosciences**

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**Can women have it all? A look at work family idealization in premedicine female students**

Anna Shapiro, Department of Anthropology

The prevalence of women in medicine has been steadily increasing as the twenty-first century progresses. As women are entering the masculine field of medicine at an increasingly fast rate, new questions arise about how women balance work and family. One way that this is done is through MD² marriages (Hinze, 2004). MD² marriages are dual physician marriages, and research has shown that these marriages often result in a continuing perpetuation of more traditional gender roles (Hinze, 2000). Ideals of traditional gender role perpetuation also have been found to be common in a more general undergraduate population (Stone and McKee, 2000). However, little information has been explored in the literature about what are the desired gender roles for female pre-medicine students, students who might be expected to have more progressive gender role ideals. This study explores idealized gender roles for female pre-medicine students. As part of these roles, we intend to investigate what the idealized marital situation is, and the idealized caregiver. Based on participant interviews, idealizations were based on participants’ mothers and the example of work family balance that was demonstrated for them. Deviation from the example and a professed self-interest lead many participants to feel “selfish”. In this situation, the student finds herself torn between what she believes is her “selfless” goals (motherhood), and her “selfish” goals (physician.) These selfish and selfless goals are direct reflections of the participants’ maternal example, and leave the participants unable to reconcile these goals.

**Project Mentor: Dr. Eileen Anderson-Fye, Department of Anthropology**
Morphologic and Immunohistochemical Assessment of Intestinal Tumors: Effects of dietary iron on growth and prevalence of intestinal tumors

Luke Shivers, Department of Nutrition

Iron’s relation to colorectal cancer has been investigated, and population studies have revealed that people who have a high dietary iron intake have a greater risk of developing colorectal cancer. This research investigates iron’s role in murine colorectal cancer by using a mouse model susceptible to adenomatous polyps. The mice were divided into three treatment groups with varying amounts of dietary iron. I investigated tissue samples stained with TUNEL to assess apoptosis in the three dietary groups. The intestinal cells were counted and scored in the crypt-villus region of well-defined tissue samples to determine dietary iron’s effect on intestinal apoptosis.

Project Mentor: Dr. James Swain, Department of Nutrition

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Design and Synthesis of Magnetic Core-Shell Nanoparticles

Shruti Sudhakar, Department of Biomedical Engineering

Magnetic nanoparticles have been widely used for a variety of biomedical applications. Our primary effort is to fabricate magnetic core-shell nanoparticles (CSNPs) using a novel technique known as polymer self-induced graft polymerization (SIGP). The monomer, 3-(trimethoxysilyl) propyl methacrylate (TPMA) was used as a coating material for superparamagnetic iron oxide (SPIO), followed by the SIGP process with graft polymerization with polyethyleneimine (PEI), to create magnetic CSNPs with a TPMA hydrophobic core and a PEI hydrophilic shell. Dynamic laser scattering (DLS) analysis shows that the resultant nanoparticles were very stable in an aqueous environment, and the particle size distribution was between 100-200 nm, which is the desired size for biomedical applications. Zeta-potential analysis shows a positively charged surface due to the PEI shell layer rich of amine groups. These unique magnetic CSNPs have the potential to provide a versatile nanoplatform for surface bio-conjugation, tumor-targeted drug delivery and magnetic resonance imaging (MRI).

Project Mentor: Junmin Zhu, Ph.D, Department of Biomedical Engineering

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Leading the Way to Lead Poisoning Prevention

Ellen Sunderland, School of Nursing

The city of Shaker Heights was established in 1912. Most of the buildings in the city predate the 1950s and are therefore very likely to have lead in them. When children are exposed to lead, they are put at risk for very severe physical, mental and behavioral problems such as hearing problems, stunted bone growth and neurological deficits. To prevent lead exposure, a 30 minute educational program featuring a PowerPoint presentation on the risks and prevention methods for lead poisoning and a question and answer period was developed. The presentation was given to seven people at a parents’ group at the Shaker Heights Library as well as twenty-one Shaker Heights City Hall employees at separate times. A pretest and posttest were administered to determine the effectiveness of the program. The pretest included 5 knowledge-based questions along with 2 opinion questions. The posttest contained only the 5 knowledge-based questions. Pamphlets and flyers about lead exposure and poisoning from the Center for Disease Control and Prevention, the Environmental Protection Agency and the Shaker Heights Health Department were also passed out to the program attendees after the posttest was administered. The program was successful in raising test scores by 44.7% from pretest to posttest. The program will continue to be available at the Shaker Heights Health Department for future lead poisoning prevention presentations.

Project Mentor: Marcella Hovancsek, RN, MSN, School of Nursing

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Surveying Physician Knowledge and Attitudes Regarding Counseling Women on Alcohol Usage Before and During Pregnancy

Courtney Thomas, Department of Biology and Psychology, Yoav Littner, Department of Neonatology, Cleveland Clinic Foundation

Fetal Alcohol Spectrum Disorders (FASDs) are a group of conditions that can occur in an individual whose mother consumed alcohol during pregnancy. The current estimate is that FASDs occur in about 2 in every 1,000 births in the United States. In addition, in the past decade this rate has not decreased nor has the rate of pregnant women reporting use of alcohol during pregnancy. Currently, there is no treatment for FASDs however they are entirely preventable if a woman abstains from alcohol throughout her pregnancy. This research surveys physicians in the areas of obstetrics, family medicine, and pediatrics due to the likelihood that they will be interacting with pregnant women or women who could become pregnant. The purpose of this study is to assess physicians’ knowledge about FASD counseling practices and attitudes regarding the issue of alcohol consumption during pregnancy. In addition, we will assess whether physicians’ moral beliefs and attitudes regarding alcohol consumption play a role in how physicians counsel women on the issue. By identifying the factors that determine if/how a physician counsels a pregnant woman or any woman of child-bearing age will allow us to form a plan to improve counseling practices and thereby increase women’s knowledge of alcohol consumption during pregnancy and the risk of FASDs.

Project Mentor: Joseph Koonce, Department of Biology

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Diet-altered catabolic disposal of 4-hydroxynonenal and analogs in rat livers

Kristyen Tomcik, Department of Nutrition; Qingling Li, Department of Nutrition; Shenghui Zhang, Department of Nutrition; Michelle A. Puchowicz, Department of Nutrition; and Guo-Fang Zhang, Department of Nutrition

Previous work in perfused rat livers has demonstrated that 4-hydroxynonenal (HNE) is catabolized predominantly via beta oxidation. Therefore, we hypothesized that perturbations of beta oxidation, such as diet-altered fatty acid oxidation activity, could lead to changes in HNE levels. To test our hypothesis, we (i) developed a simple and sensitive GC/MS method combined with mass isotopomer analysis to measure HNE and HNE analogs, 4-oxononenal (ONE) and 1,4-dihydroxynonene (DHN), and (ii) investigated the effects of four diets (standard, low fat, ketogenic very-high-fat, and high-fat mix) on HNE, ONE, and DHN concentrations in rat livers. Our results showed that livers from rats fed ketogenic diet or high-fat mixed diets had high o-6 polyunsaturated fatty acid concentrations and markers of oxidative stress. However, higher concentrations of HNE (1.6 ± 0.5 nmol/g) and ONE (0.9 ± 0.2 nmol/g) were found in livers from rats fed the high-fat mix diet compared to the ketogenic diet. Livers from rats fed the ketogenic diet had lower HNE (0.8 ± 0.1 nmol/g) and ONE (0.4 ± 0.07 nmol/g), similar to rats fed the standard diet. A possible explanation is that the predominant pathway of HNE catabolism (i.e. beta oxidation) is activated in the liver by the ketogenic diet. This is consistent with a 10-fold decrease in malonyl-CoA in livers from rats fed a ketogenic diet compared to the high-fat mix diet. Livers from rats fed the ketogenic diet had lower HNE (0.8 ± 0.1 nmol/g) and ONE (0.4 ± 0.07 nmol/g), similar to rats fed the standard diet. The accelerated catabolism of HNE lowers HNE and HNE analog concentrations in livers from rats fed the ketogenic diet. On the other hand, rats fed the high-fat mix diet had high rates of lipid synthesis and low rates of fatty acid oxidation, resulting in the slowing down of the catabolic disposal of HNE and HNE analogs. Thus, decreased HNE catabolism by a high-fat mix diet induces high concentrations of HNE and HNE analogs. The results of our work suggested a potential causal relationship to metabolic syndrome induced by western diets (i.e. high fat mix), as well as the effects of the ketogenic diet on the catabolism of lipid peroxidation products in liver.

Project Mentor: Dr. Guo-Fang Zhang, Department of Nutrition
Mapping to the Frankfort/ Sella planes coordinate system using MIPAV (Medical Image Processing Analysis & Visualization) and Application to Tri-planar Cephalometric Analysis

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**Purpose:** To evaluate Tri-planar cephalometry by MIPAV in comparison to conventional 2D cephalometric analysis and to establish new para-sagittal landmarks.

**Background:** Cephalometry is a quantitative description of morphological deviations and evaluates change over time and growth process. Cephalometric analysis helps to make diagnostic and treatment planning decisions. There are different ways in which cephalometric analysis is done. The conventional cephalometric analysis where selected lines and angles are measured from 2D cephalogram and a more moderate method is Tri-planar cephalometry, which enhances precision, by using a 3D datasets. MIPAV is a NIH image processing software that is written in an open source Java code and has extensibility. In this study, for the first time, MIPAV is used as tri-planar cephalometric software.

**Methods:** By using right-left porions, left Orbitale and Sella points, patient position was aligned. Frankfort plane, Intersects Porions and Orbitale points. Sella plane intersects Sella, perpendicular to the Frankfort plane and Orbitale line. The mid-sagittal plane intersects Sella, perpendicular to the sella and Frankfort planes. The Frankfort, Sella, and mid-sagittal planes were aligned with the X, Y, and Z axis to transform dataset into the Frankfort/ Sella coordinate system. Selected lines and angles were then measured and recorded from the new, aligned dataset. Measurements were then compared with the Bolton Standard to display the deviations between the patient and normal standards.

**Result & Conclusion:** using our new cephalometric coordinn, MIPAV can be used as powerful tri-planer cephalometric software. Results were reliable and repeatable with different operations. In future, by writing a novel plugin, MIPAV will perform automatically after landmarks identification and registration.

*Project Mentor: Arun Gosain MD. School of Medicine, Plastic Surgery Department*

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A transgenic study of molecular mediators of neural degeneration at the cortical-tissue device interface

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Intracortical microelectrodes can communicate with small neuronal populations to translate one’s ‘thoughts’ into functional outputs. While these devices have great potential to help individuals with neurological deficits, widespread clinical use of this technology is hindered due to the lack of reliability of chronic recordings; which is largely attributed to the inflammatory response. Primary inflammatory events at the device-tissue interface are comprised of microglia cell adherence to the surface of the electrode and astrocytic encapsulation of the electrode (formation of the ‘glial scar’). This inflammatory response is believed to mediate a localized neurodegenerative environment through the overexpression of numerous small molecules involved in wound healing and cell signaling. Our lab is interested in identifying a cellular pathway to facilitate the inhibition of the formation of neurotoxic zones around the electrode. This study utilizes transgenic mice to investigate the role of pathogen-associated cellular receptors. First, we implanted microelectrodes into cluster of differentiation 14 (CD14) deficient mice and analyzed the tissue response at both acute and chronic time points. CD14 is a co-receptor for both Toll-like Receptors 2 and 4 (TLR2 and TLR4), which recognizes pathogen-associated molecules in the propagation of neuro-inflammation and neurodegeneration. These mice demonstrated significant neuroprotection at the microelectrode-tissue interface,
through the down-regulation of both microglia and astrocyte activation. Therefore, we have begun to utilize transgenic knock-out mice for both TLR2 and TLR4 to further understand their role in neurodegeneration.

*Project Mentor: Professor Jeffrey R. Capadona, Department of Biomedical Engineering*

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**Enhancing Mechanical and Solubility Resistance Properties in Poly(vinyl alcohol) Aerogels**

**Zach Weinrich**, Macromolecular Science and Engineering

The goal of this project was to produce a poly(vinyl alcohol) aerogel with enhanced properties. This work focused on increasing mechanical properties and decreasing water solubility through cross-linking with a dicarboxylic acid. The type, concentration and curing temperature of the diacid were the variables taken into account. To test for water solubility, poly(vinyl alcohol) films with set amounts of diacid were cast, cured, and put through a vigorous solubility test to see how much of the film had dissolved after eighteen hours. To test the mechanical properties, aerogels with the varying concentrations of diacid were created through the published aerogel freeze-drying process, cured, and then compression tested. A color change was observed when curing the diacid containing films and aerogels. Results show a major decrease in water solubility, some showing as high as 87% of the film remaining, where the control dissolved completely. In mechanical testing, the diacid modified aerogels performed better on average than the control samples exhibiting much tougher characteristics, while a slight increase in modulus was seen from some of the samples.

*Project Advisor: David A. Schiraldi, Macromolecular Sciences and Engineering*

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**Integrating Multiple Modeling Paradigms using the Modeling Platform Nova to Model Chemotaxis in Dictyostelium Discoideum Amoebae**

**Alexander White** – B.S. Candidate in Systems Biology 2014; Alexander Conway B. S. Oberlin Mathematics Department; Richard Salter PHD, Oberlin Department of Computer Science; Peter Thomas, Departments of Mathematics, Biology, and Cognitive Science

Colonies of *Dictyostelium* amoebae use chemotaxis, the directed movement of cells through a chemical gradient, to form multicellular aggregates. This process is an example of a complex, hierarchical, emergent behavior typical of many biological systems. Exploring such systems through modeling requires novel tools that can flexibly represent both the internal dynamics of individual agents and external interactions between them. Single celled *Dictyostelium* amoebae produce the signaling molecule (5'-3')-cyclic adenosine monophosphate (cAMP), sense the local cAMP concentration gradient, and move towards the aggregation center. From a modeling perspective this process incorporates dynamic, stochastic, and discrete (agent based) elements. Often it is hard to create a model that looks at a system from all three perspectives. Using a new modeling program, NOVA, designed by Prof. Richard Salter of Oberlin College, we created a hierarchical, agent-based model of *Dictyostelium* chemotaxis. NOVA efficiently combines dynamical modeling and agent based modeling in a single unified graphical user interface GUI. To test NOVA in this situation, we designed agents with internal dynamics described by Loomis and Laub’s model of cAMP signaling production (Laub and Loomis, Mol Biol Cell., 1998), and a stochastic gradient sensing method to determine direction. On a global level, we allowed gradients of cAMP to form by diffusion, and placed on the order of 300 amoebae in a computational spatial domain. We were able to see streaming and aggregation centers within our model, confirming NOVA’s ability to reproduce experimentally observed behaviors. Future work will include further model verification as well as attempts to reduce the model to smaller effective models e.g. of populations of limit cycle oscillators coupled by diffusion.

*Project Mentor: Peter J. Thomas, Departments of Mathematics, Biology, and Cognitive Science*
The role of material strain in triboelectric charging and charge transfer

Ross Widenor, Department of Chemical Engineering; Mamadou Sow, Department of Chemical Engineering; Dr. Ajay Kumar, Department of Chemical Engineering; Seung Whan Lee, Department of Chemical Engineering

It is well known that materials can build up static charge when they are rubbed together, referred to as triboelectric charging. Classically, one thinks of rubbing an inflated balloon on hair or socks on a carpet. This phenomenon also manifests itself in a number of real-world circumstances, such as dust storms, where large electric potentials are created by particle collisions and lead to lightning. Despite the existence of these common occurrences, the fundamental mechanism behind triboelectric charging remains poorly understood. This summer, I studied the affect of material strain on triboelectric charging. In my experiments, I found that a relaxed piece of latex that is contacted with a piece of Teflon causes the Teflon surface to accumulate net positive charge, while latex that is inflated like a balloon and presumably strained, causes the Teflon surface to accumulate net negative charge. This behavior was reproduced successfully for 55 out of 56 trials with deflated latex and in 56 out of 56 trials with inflated latex. Overall, this study represents the first clear evidence of material strain causing a reversal of charge transfer in triboelectric charging.

Project Mentors: Professor R. Mohan Sankaran, Department of Chemical Engineering and Professor Daniel Lacks, Department of Chemical Engineering

False Associative Memory: Exploring the Revelation Effect Using Verbal and Numerical Tasks

Tianna Xia, Department of Psychology and Biology

This study investigated false recognition memory. A list of 210 words was read to the participants. Afterwards, a set of 44 words was read and the participants were instructed to mark their answer sheet with either a positive response if they believed the word was in the first list or a negative response if they believed the word was not in the first list. People are prone to mistakenly say yes to words that are semantically related to words of the original list. Additionally, they are more likely to say yes if they complete a verbal task immediately before the word is presented to them. This experiment combined these two manipulations and tested whether individuals were more likely to form false associated memories when exposed to these two conditions. It further tested whether the same effect could be induced using a numerical task rather than a verbal task. The first part of this experiment showed there were frequent false positive responses to associated words and that this effect was significantly increased when participants were given a verbal task. The second part of this experiment showed there was no significant increase in false memory when participants were given a numerical task.

Project Mentor: Dr. Robert L. Greene, Department of Psychology

Quantifying Cardio-Respiratory Coupling with an Empirical Oscillator Model

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Cardio-respiratory coupling (CRC) is a physiological phenomenon corresponding to the mutual relationship between the rhythm of breathing and that of the heartbeat. In this study, CRC and its mediation through the vagus nerve were examined using methods principled on a model of generic coupled phase oscillators. Our collaborators from the Department of Medicine, Drs. Hsieh, Dick and Jacono, provide us with respiratory EMG (electromiogram, which
measures diaphragm contraction), and EKG (electrocardiogram) recordings, performed simultaneously, for anesthetized rats. Specifically, recordings were obtained before and after cutting the vagus nerve (vagotom). Our goal is to detect and quantify the magnitude of the coupling as well as its directionality. To this end, I work with Dr. Galán to develop the computational and theoretical framework of the analysis. In particular, we improve upon previous methods used to study coupling of generic oscillators and implement these tools to study CRC in detail. We compute a coupling index as well as a coupling function which describes the degree of interaction between both oscillatory systems, obtained by fitting the recordings to a generic model of coupled phase oscillators. Importantly, these measures of coupling are directional, which allows us to determine which oscillator is more efficient at driving the other. Thus far, we have used our methods to characterize the baseline (CRC in anesthetized rats), yielding results consistent with physiology. That is, we observe unidirectional coupling, with the heartbeat driving respiration. And after vagotomy, we find that there is no presence of coupling in either direction. In the near future, we aim to extend our analysis to study CRC under different physiological conditions, e.g. sepsis forced ventilation, and different anesthetics, e.g. isoflurane. Ultimately, we aim to apply this technique to quantify CRC in human patients to aid the diagnosis of cardio-respiratory pathologies in a non-invasive, efficient manner.

Project mentor: Roberto Fernández Galán, PhD., Department of Neurosciences, School of Medicine

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Effects of Competition Distance and Soil Origin on Plant Invasions

Nicole M. Zimmerman, Department of Biology; Angela J. Brandt, Department of Biology; S. Conor Leahy, Department of Biology; Lauren Huffman, Department of Biology; and Jean H. Burns, Department of Biology

Studies have suggested that the competition distance between an invading plant and resident plant affects invasibility and that soil composition affects the relationship between phylogenetic distance and competition distance. To examine the interaction between these effects for the first time, we planted eight species of plants in soil from their rhizosphere and in from the rhizosphere of their congener. We manipulated the competition distance for invaders by planting invading congener plants at five, ten, and fifteen centimeters away from an established resident plant. After one month, we measured the biomass of the resident and the invader to determine the extent to which the invasion succeeded. A generalized linear model comparing the interactions of soil identity, invader identity, and competition distance revealed that the interaction of competition distance and the identity of the invader determine the biomass of the invader. However, data revealed no soil influence upon competition distance or phylogenetic distance, refuting suggestions from previous research. By understanding the interaction between invader identity and competitive distance, we can parameterize competition models, predicting the conditions where invasion might occur. These results will be useful to land managers developing restoration plans for natural areas, where the establishment of native species in developing communities is critical.

Project Mentor: Professor Jean H. Burns, Department of Biology

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The Effects of Calcium Abundance on Inducible Defenses in Freshwater Snails

Kristen Zozulin, Department of Biology

The ability of prey to adapt to changing environments is often a crucial part of their ecology. The interactions between phenotypic changes in response to the risk of predation and factors such as food availability on these organisms have been documented. However, the effects of less obvious alterations in an animal’s environment, such as ion concentrations in the water, have been largely overlooked. In freshwater systems, snails form their shells using calcium drawn from the water, and calcium concentration can serve as a limiting resource for shell growth and thickness. In this study, we will investigate the effects of combining an
abundance of calcium and predatory cues on the behavior and morphology of the freshwater snail *Helisoma trivolvis*. We will examine this interaction using four treatments exposing snails to high (~100 mg/L) and low (~40 mg/L) calcium concentrations as well as the presence and absence of the predatory water bug *Belostoma flumineum* and measuring the effects of these treatments on behavior, snail mass, shell aperture shape, and shell thickness. We predict the treatment with both elevated calcium concentration and predatory cues will produce snails with overall thinner shells than those only exposed to elevated calcium levels because of metabolic trade-offs in producing both induced defenses and more robust shells. The effect that calcium concentration has on the induced defenses in snails is indicative of the complex interactions organisms have with their environment and highlights the necessity of taking into account multiple ecological factors when studying living systems.

*Project Mentor: Professor Michael Benard, Department of Biology*