



The 4th Annual



Fall

Undergraduate

Research

Festival

Wednesday, December 4, 2013
4:30pm-6:30pm

University of Iowa
University Capitol Centre
2nd floor South Atrium
Iowa City, Iowa

This event is hosted by the Iowa Center for Research by Undergraduates.

ICRU promotes undergraduate involvement in research and creative projects at the University of Iowa, serving students, staff, and faculty.

The Fall Undergraduate Research Festival is proud to showcase over eighty poster presentations given by University of Iowa undergraduate researchers. These students work in more than 30 different departments and majors, and represent each of the senior, junior, sophomore, and freshman classes.

Students have been asked to stand by their posters for either the first or second hour, and then are free to visit their fellow presenter's posters during the other hour.

Odd numbered posters will present from 4:30-5:30PM
Even numbered posters will present from- 5:30-6:30PM

Many thanks to the over 100 graduate students who have volunteered their time to serve as poster judges for this event.

Upcoming ICRU Events and Opportunities

Excellence in Undergraduate Research Award - March 2014

Distinguished Mentor Award - March 2014

Spring Undergraduate Research Festival - April 2014

Research in the Capitol - April 2014

ICRU Research Fellows Applications Due - March 2014

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List of Presenters

1 - Association between olfaction and higher cortical functions in Alzheimer's disease

Presenter: Erin Abbas

Presenter: Jamie Dunlap

Major: Psychology

Mentor: Daniel Tranel (Neurology/Psychology)

- **Abstract:** Patients with Alzheimer's disease (AD) often present with impairments in olfaction early in the disease. The piriform cortex, in and near the orbitofrontal cortex (OFC) and anterior medial temporal lobe (AMTL), subserves smell functioning. The OFC and AMTL are associated with decision-making and emotional memory, respectively. Early pathology in AD may affect the piriform cortex disproportionately, which could lead to impairments in smell functioning, emotional memory, and decision-making. We tested the prediction that olfactory functioning would correlate with decision-making and emotional memory. Patients with AD (N=8) and healthy elderly participants (N=8) were tested on smell (smell identification, odor memory), emotional memory (recall and recognition of emotional and neutral pictures), and decision-making (Iowa Gambling Task, Balloon Analogue Risk Task) procedures. The Wechsler Test of Adult Reading was administered as a control task. We found a significant association between olfaction and both emotional memory and non-emotional memory (p 's $< .05$). No significant association was found between olfaction and decision-making or reading (p 's $> .05$). The discrepancy between emotional memory and decision-making may reflect greater decline in the AMTL. The findings suggest that measuring olfaction could provide an efficient means of assessing the integrity of the anteromesial temporal lobe in aging and AD.

2 - Investigating the Role of Antigen Presentation in Bullous Pemphigoid, an Autoimmune Skin Disease

Presenter: Samantha Aust

Majors: Biology & Psychology

Mentor: Kelly Messingham (Dermatology)

- **Abstract:** Autoimmunity results from the inability of the immune system to discriminate between self and non-self. Bullous pemphigoid (BP) is an autoimmune disease targeting epidermal attachment proteins resulting in inflammation and blistering of the skin. Recent studies suggest that responses to epidermal antigens are generated largely within the skin itself through antigen presenting cell (APC)-mediated activation of regulatory T cells (Treg). Others noted fewer T-cells in BP skin, compared to normal skin. Since differences in antigen presentation could contribute to autoimmunity, the goal of these studies was to evaluate the number of APCs in BP vs. healthy skin. To test this, skin samples were cryosectioned and stained with fluorescent antibodies specific for APC's, T cells and visualized using an epifluorescent microscope. Staining with MHC class II, a universal marker of APC, revealed a decrease in the overall number of APC in BP skin, compared to control. Furthermore, T cell localization near APCs was also decreased in BP skin. Future experiments will evaluate the number and activation state of different APCs known to reside in the skin, such as dermal dendritic cells and Langerhans cells, and explore their proximity to T cells (Treg, Th1, Th2, Th17) using immunofluorescent confocal microscopy.

3 - Quantifying Door Openings in a C-Section Operating Room

Presenter: Brennan Ayres

Major: Biomedical Engineering

Mentors: Priyadarshini Pennathur (Mechanical & Industrial Engineering) & Loreen Herwaldt (Internal Medicine, Public Health)

- **Abstract:** Surgical procedures are influenced by factors such as surgical skill, patient conditions, and surgical environment [1]. Environmental factors include operating room (OR) layout and organization and distractors such as surgical door openings. This work focuses on identifying the frequency and rationale for door openings in a university hospital labor and delivery (L&D) OR. Numerous studies have been performed for orthopedic ORs, correlating door openings with an increased risk of surgical site infections from distractions and worsening air quality. No previous studies have focused on door openings in specialized ORs such as L&D. C-section deliveries were observed to gather data on door opening frequency, duration, and reasons for occurrence. L&D staff completed an online survey to understand staff perceptions of door openings. Findings from this study will help develop recommendations and interventions to reduce the number of door openings. Authors: Brennan Ayres; Salavador Rojas; Farznaeh Dolati; Priyadarshini Pennathur, PhD; and Loreen Herwaldt, M.D.

4 - A new genetic model to study the skin blistering disease Epidermylosis Bullosa Simplex-Dowling Mera (EBS-DM)

Presenter: Gabriel Baccam

Major/Minor: Biochemistry/Chemistry

Mentor: Lori Wallrath (Biochemistry)

- **Abstract:** Epidermylosis Bullosa Simplex- Dowling Mera (EBS-DM) is a human skin blistering disease characterized by fluid filled blisters that form at friction sites of the body. EBS is caused by dominant mutations in Keratin 14 (K14) gene. Keratins are intermediate filaments that heterodimerize and form filament bundles in the cytoplasm of epithelial cells. K14 binds to Keratin 5 (K5) to form a dimer that then forms filaments in the basal layer of the skin. How mutant K14 causes skin blistering is not known. To determine the disease mechanism, we developed a genetic model using *Drosophila* (fruit fly) to study keratin function in epithelial cells. The *Drosophila* genome does not encode for keratins. Expressing wild type K14 and K5 in transgenic flies causes the formation of cytoplasmic bundles without apparent phenotypes. In contrast, expression of mutant K14 and wild type K5 produces blistered wings; two epithelial cell layers made up the wild type wing. We are determining whether the blistered wing phenotype is due to loss of cell-cell adhesion between the epithelial layers and/or altered biological signaling pathways. Our results will provide potential avenues for therapy.

5 - The economic and environmental benefits of cooperatively owned chocolate companies for smallholder farmers: Expanding on fair trade and developing bean-to-bar models of chocolate production in Ecuador

Presenter: Ashlee Baeten

Majors: International Studies & Geography

Mentor: Margaret Carrel (Geography)

- **Abstract:** Cocoa is a very important commodity in global trade, with over 50 million people employed in cocoa production and chocolate processing globally. Geographically, cocoa production is limited to equatorial regions, while chocolate consumption is primarily in Europe and North America. This dichotomy has economic implications for farmers in third world countries who do not make a living wage off of the 10 billion dollar chocolate industry. The fair trade movement developed in response to these economic disparity issues, first in response to the plight of coffee producers, but now encompasses many other agricultural commodities. Chocolate farmers definitely have the potential to prosper economically from Fair Trade certification, but some of the issues with Fair Trade can be better addressed by improved models, such as bean-to-bar. In this paper, I will explore the benefits associated with bean-to-bar chocolate production in Ecuador and focus on the successful example of Kallari Association. I will trace the development of the modern chocolate industry, explore the economics and ethics of the world's top chocolate producers, and see if the chocolate industry has any lessons to learn from the coffee industry's head start with Fair Trade certification. I will conclude with a discussion of development ethics and how cocoa farmers and aspiring bean-to-bar chocolate cooperatives can ethically benefit farmers and local communities.

6 - "Chillax Doesn't Go With This": Positioning Leaders and Readers Through Language Stories

Presenter: Elizabeth Barclay

Presenter: Melanie Hester

Major/Minors: Elementary Education/Reading Specialization, Social Studies Specialization, Teacher Leader Certification

Mentors: Renita Schmidt & Amanda Haertling-Thein (Education)

- **Abstract:** The Strong Girls Read Strong Books Book Club is a qualitative research project developed by Drs. Renita Schmidt and Amanda Haertling-Thein. Our research team meets for two hours each week with 50 ethnically and socioeconomically diverse fourth-, fifth-, and sixth-grade grade girls to explore what it means be strong girls. During the book club, participants read and discuss literature and other important life issues and respond in a variety of other ways. Our goals are to build literacy confidence in girls and provide a space for them to encounter a variety of perspectives about what it means to be a strong girl in today's society. In this work we consider these research questions: How do students' cultural and/or life experiences shape our communication and language styles during book club? In what ways do race and age become factors in student leader relationships in a book club? How do students use their understanding of race to position the teacher leader?

7 - Atomic Illinois

Presenter: Angela Barr

Major: Studio Arts (Intermedia)

Mentor: Sarah Kanouse (Studio Arts)

- **Abstract:** Over the summer I worked with Intermedia Professor and research artist Sarah Kanouse to research and create a working map of all sites related to nuclear development and testing in the Illinois area. The maps were in the form of several google maps, and an eventual large scale, more detailed map with demographic information included. The research was compiled in a dossier/workbook. These data were then used to facilitate discussion at a design charrette in Champaign/Urbana in

October.

8 - The Meaning of Abracadabra: Ancient Medicine in the Liber Medicinalis

Presenter: Katherine Beydler

Majors: Classical Languages & Plant Biology

Mentors: Robert Ketterer & Marquis Berrey (Classics)

- **Abstract:** I translated the Liber Medicinalis, an obscure Roman medical book of the second century CE, from Latin to English in order to study it in the context of medicine from different time periods. To do this, I first researched the ancient sources of the Liber Medicinalis to ascertain how medical thought changed between the time of historical doctors like Hippocrates and the late Roman Empire. I then examined three late medieval commentaries on the work to assess what doctors and scholars in the 16th century thought of Roman medicine, particularly regarding its superstitious and magical elements. Lastly, I considered the impact of the Liber Medicinalis and other ancient medical treatises on current Western medical thought, tradition, and folklore.

9 - Somatic Akirin Rescue of Germline in *C. Elegans*

Presenter: Rich Bowman

Major: Comprehensive Biology

Mentor: Sarit Smolikove (Biology)

- **Abstract:** Akirin is an evolutionarily conserved protein, with diverse biological functions. During development in *Drosophila* and mice it was shown to promote myogenesis. In *Drosophila* it acts as enhancers to mediate interactions between twist and the Brahma complex during muscle development. Our previous studies have shown that Akirin/AKIR-1 is required for meiosis in *C. elegans*. However, the role of Akirin in development was not studied in this model organism. We aim to examine if *akir-1* has any function in *C. elegans* development and, if so, if this function is similar as observed in other systems. We have found that AKIR-1 expression in the soma rescues embryonic lethality without suppressing the meiotic defects, indicating that the meiotic defects and the developmental defects of this gene are uncoupled and that embryonic lethality is caused by the developmental defects and not by carry-over of meiotic errors. We have also found that the absence of AKIR-1 has no significant effect on expression of *C. elegans* Twist regulated promoter in the vulva muscles, nor does its absence have a significant effect on the number of seam cells in adults. This data suggested that although Akirin's involvement in development is conserved, its precise function is divergent.

10 - How does product-to-parent reversion affect the transport and fate of Trenbolone in stream networks?

Presenter: Colleen Brehm

Majors/Minor: Civil & Water Resources Engineering/Geoscience

Mentors: Adam Ward (Earth and Environmental Sciences) & David Cwiertny (Civil and Environmental Engineering)

- **Abstract:** Trenbolone (TBA) [17 β -(acetyloxy)estra-4,9,11-trien-3-one] is a highly steroidal synthetic testosterone that is used as a growth promoter and injected into over 20 million cattle annually. It has

been found that product-to-parent reversion occurs in environmental conditions, such as streams. The reversion that occurs causes regeneration of TBA during “non-light” periods (night) after it has photodecayed during daylight hours in recent laboratory studies. In streams, this would occur both during the night and in the near-stream subsurface, or hyporheic zone. To quantify the effect of the reversion reaction, we constructed a 1-D model of stream transport and fate for TBA. Reversion occurs in the near-stream subsurface (hyporheic zone) and stream channel itself; photodegradation occurs only in the stream during daylight hours and proportional to light intensity. We conducted a series of model experiments to quantify how much reversion affects the peak, mean, and minimum concentrations of TBA in a stream. The model showed that the reversion reaction results in indefinite persistence of about 40% of the TBA loading to the stream. In contrast, common rationale for the use of this steroid cites the rapid photodegradation as evidence of limited impact. The results of our modeling demonstrate the importance of the product-to-parent reversion process in stream networks, and suggest common environmental sampling and permitting procedures must be reconsidered for compounds with product-to-parent reversion processes. Authors: Colleen Brehm, Adam S. Ward, David M. Cwiertny, Edward P. Kolodziej

11 - Purification of phage phiC31 integrase protein using a protein splicing system: Isolation of an enzyme to make transgenic frogs.

Presenter: Zac Builta

Presenter: Ai-Chi Hong

Major: Biochemistry

Mentors: Dan Weeks (Biochemistry)

- **Abstract:** The bacteriophage phiC31 encodes an integrase that can mediate the recombination of a circular piece of DNA containing a specific 36 base pair sequence into any genome with an appropriate 40 nucleotide recognition site. Purified integrase is expected to simplify experiments that will make transgenic animals to study gene control and function. In order to purify phiC31 integrase we have cloned the gene encoding this protein into plasmids that allow the expression of a protein fusion in bacterial cultures. This fusion allows rapid purification of integrase as a pro-protein. In the junction between the integrase and the rest of the protein is an intein cleavage site. Inteins allow the non-enzymatic cleavage of the protein, releasing the integrase in a purified form. We will report on our progress purifying phiC31 integrase.

12 - Application of Near-Infrared Spectroscopy to Measurements of Nocturnal Hypoglycemia: in vitro Simulations

Presenter: Corey Burns

Major: Chemistry

Mentor: Gary Small (Chemistry)

- **Abstract:** Infrared spectroscopy is gaining increased importance for use in quantitative analyses. The near infrared (NIR) region, corresponding to combinations and overtones of relevant glucose vibrations, has been found especially useful in the development of quantitative methods for aqueous-based samples. Our laboratory has a long-standing interest in applying NIR spectroscopy to in vivo measurements of blood glucose. Despite the large aqueous background absorbance of human tissue, glucose absorption bands can be identified in the NIR region. The work described in this presentation

focuses on the development of a continuous non-invasive nocturnal hypoglycemic alarm. Such an alarm would be valuable to measure glucose while a patient sleeps. In implementing the alarm, spectra are collected continuously while and classified based on a threshold. A reference spectrum is collected prior to sleep for future classification. For each spectrum collected afterwards, the ratio is taken to the reference spectrum to yield a differential spectrum. The differential spectrum is then classified using piecewise linear discriminant analysis as belonging to the alarm or non-alarm data classes. This methodology is tested in vitro to simulate a sleep cycle and its performance is evaluated with to simulate the spectral properties of human tissue. Varying concentrations of lactate are used to simulate the presence of a close spectral interferent.

13 - Donut Dollies in the Vietnam War

Presenter: Ellysa Cassier

Majors/Minors: History & Secondary Education/Political Science, Gifted Education, Coaching

Mentors: Stephen Vlastos & Jeffery Cox (History)

- **Abstract:** My poster focuses on the research I have conducted concerning the Donut Dollies in the Vietnam War. The Donut Dollies, or Supplemental Recreational Aides Overseas as they were also called, were a branch of the American Red Cross. These single, college graduate women in their twenties went through an extensive interview process in order to serve in Vietnam. They were given very little training from the American Red Cross and were sent to Vietnam to serve a year-long tour. While on tour, these women were stationed on large military bases and would fly or drive to smaller bases each day. While at these bases, the women would develop programs for the soldiers. These programs included games and activities related to popular culture, celebrities, and other interesting topics. The women would also help out around the hospital and base if need be. In my thesis, I argue that while these women were expected to be programmers for the soldiers, they often assumed other roles and were extremely underprepared for other experiences.

14 - Applied Game Design: City of Lit.

Presenter: Patrick Chang

Major: Business Management

Mentors: Jon Winet & Nicole Dudley (Digital Studio for Public Arts & Humanities)

- **Abstract:** In 2008, Iowa City was designated by UNESCO as a City of Literature. To promote and celebrate this accomplishment, I was brought on-board to accomplish this goal via game design. The goal is singular but at the same time open ended and could have been approached at in a myriad of ways, but by using the same game design process applied in video game design I hoped to solve the problem introspectively. Game design places an emphasis on putting the designer in the shoes of the person participating in the activity itself. A game/activity was the chosen medium to convey the knowledge that Iowa became a City of Literature because of the degree of immersion people have when participating versus being a mere recipient. The game design process involved taking into account multiple variables such as enjoyment, interest, retention, and most importantly the issue of feasibility. The end goal is to create a game that can be enjoyed by the target audience while fulfilling the original criterion of having educational merit.

15 - Analyzing Capping Protein localization and function using *Drosophila* oogenesis

Presenter: Xiang Chen

Major/Minors: Biochemistry/Japanese, Economics

Mentor: Tina Tootle (Anatomy and Cell Biology)

- **Abstract:** Actin and its precise regulation are essential for many processes during development. Over 100 actin binding proteins regulate actin dynamics. However, the mechanism by which these actin binding proteins are regulated is largely unknown. The Tootle lab uses *Drosophila* oogenesis to study actin dynamics and has found evidence suggesting prostaglandins, small lipid signaling molecules synthesized downstream of cyclooxygenase (COX) enzymes from arachidonic acid, regulate actin binding proteins to temporally and spatially regulate actin remodeling. During stage 9 of *Drosophila* oogenesis, loss of prostaglandin signaling results in early actin remodeling, causing extensive actin filament and aggregate formation. During stage 10B, loss of prostaglandin signaling results in decreased actin filament formation and abnormal bundle formation. Through a pharmaco-genetic interaction screen, heterozygous loss of the genes encoding Capping Protein was shown to enhance the effects of COX inhibition, suggesting that Capping Protein may be a downstream target of prostaglandin signaling. Capping protein, a heterodimeric actin binding protein, caps the barbed ends of actin filaments to inhibit their elongation. However, little is known about this protein's localization and regulation. Thus, *Drosophila* oogenesis provides a novel model to study capping protein dynamics in vivo. Our goal is to create transgenic flies with tagged constructs of the Capping Protein beta subunit. This will allow us to analyze this protein's localization in fixed and live samples as well as protein-protein interactions through co-immunoprecipitation.

16 - Saliva as a Biomarker for Cystic Fibrosis

Presenter: Hyder Chowdry

Major: Biochemistry

Mentor: Eugene Chang (Otolaryngology)

- **Abstract:** There are three prominent salivary glands in humans and pigs: the parotid, submandibular and sublingual glands. They are composed of epithelial and ductal cells that are important in ion and water absorption and secretion. The cystic fibrosis transmembrane regulator (CFTR) ion channel is expressed in the epithelial cells of the salivary gland, and is important in the regulation of chloride (Cl), bicarbonate (HCO₃⁻), and fluid transport. The role of CFTR in salivary flow, ion composition, and pH has been studied in humans and mice, but there is conflicting data. In general, it is agreed that salivary flow is decreased in CF after stimulation, but the effect of loss of CFTR in Cl, K, HCO₃⁻, and thereby pH vary between studies. The craniofacial structure of the pig is similar to humans in many aspects and thus an ideal model to study pathophysiology of CF. Using the porcine model we hypothesize that CF pigs will have lower salivary flow rates when stimulated by isopretaline, higher sodium, chloride and potassium ion concentration and lower pH when compared to non-CF pigs.

17 - Integrating Arts into the Common Core State Standards

Presenter: Annie Christenson

Major/Minor: English/Writing

Mentor: Dora Malech (Magid Undergraduate Writing Center)

- **Abstract:** The Iowa Youth Writing Project (IYWP), a non-profit based in Iowa City, brings unique

literacy and language arts programs to some of the state's most at-risk youth via after-school/in-school support and mentorship, as well as a diverse range of extracurricular writing workshops (creative, academic, and interdisciplinary). The IYWP is currently researching Common Core State Standards and more specifically Iowa Core Curriculum, an initiative designed to provide young people the knowledge and skills necessary for success in college and careers, along with arts integration to begin the necessary steps to improving arts equity in the schools. With our research, we hope to develop a way in which IYWP volunteers can work in-school that will be seen by teachers and administrators as enhancing student's education rather than a detriment to it. With existing research, we've found arts integration improves student's abilities to retain information because they are challenged to fully understand the material by targeting each student's multiple intelligences rather than only memorizing the material, so we are creating lesson plans to be used by teachers that integrate creative and artistic thinking in science, math, and social studies units that will help student's meet the Iowa Core standards. Our goal is to increase arts equity for all students in the Iowa City school district (and hopefully the entire state of Iowa), and begin implementing arts integration into the Iowa Core Curriculum.

18 - Bathroom Humor

Presenter: Wonchul Chung

Majors: Sociology & Psychology

Mentor: Michael Lovaglia (Sociology)

- **Abstract:** I believe bathroom is one of the private places where people are freely to express their true inner feelings, unlike Facebook status, which takes into account what others will think of them. I want to do a content analysis on the stuff people write inside bathrooms throughout campus and compare between females and males. And discover any themes and patterns emerge.

19 - Examining the Role of P-granules in Cop-9 Dependent Synaptonemal Complex Morphogenesis in *C. elegans*

Presenter: Martha Dean

Major: Health and Human Physiology

Mentor: Sarit Smolikove (Biology)

- **Abstract:** P-granules are conserved organelles that have important function in germ cells of *Caenorhabditis elegans*. P-granules are thought to provide regulation of mRNA export from the nucleus in the adult germ cells. Previous research indicates that disruption of p-granules, specifically germline helicase-1 (GLH-1), results in sterility and abnormal gonad morphology. The COP-9 signalosome, a conserved protein complex, functions by stabilizing or targeting proteins for degradation. The signalosome is comprised of subunits 1-8 with the isopeptidase CSN-5 acting as the primary catalytic component. CSN-5 antagonizes KGB-1 (map kinase), which targets GLH-1 for proteasomal degradation. / Investigation of the *csn-5* deletion mutant indicates a synaptonemal complex (SC) morphogenesis is disrupted. The SC is a highly conserved structure required for formation of crossovers and therefore the segregation of homologous pairs of chromosomes. To test if CSN-5 acts in SC morphogenesis through GLH-1, we examined the SC in *glh-1* and *kgb-1* mutants. Our preliminary analysis indicated that disruption of *glh-1* or *kgb-1* does not affect SC morphogenesis, suggesting that the effects of the Cop9 complex on SC morphogenesis are not through the disruption of

P-granule function.

20 - Just winging it - the Shaker wings down story

Presenter: Andre DeGroot

Major/Minor: Biomedical Engineering/Chemistry

Mentor: Chun-Fang Wu (Biology)

- **Abstract:** In *Drosophila*, the gene *paralytic* (or *para*) encodes all voltage-gated sodium channels. Just as in humans, these channels are necessary for the propagation of action potentials along neurons, and thus mutations of *para* result in abnormal neuronal activity. We have examined several hyperexcitable *para* alleles that have displayed various phenomena, including paralysis at temperature extremes, seizures in response to physical impacts, and shaking under ether-induced anesthesia. One allele of particular interest, *Shaker wings down* (*Swd*), shows several of these abnormal phenotypes. Behavioral analysis of *Swd* through video tracking and activity monitoring demonstrated abnormal, ataxic locomotion, marked with substantial seizing. This project aims to delineate the underlying neurological and genetic processes that cause these unique dysfunctions. Through genetic complementation crosses between *Swd* and other alleles of *para*, heteroallelic flies were produced and underwent phenotypic assays to identify genetic enhancers and suppressors of the mutant phenotypes and to determine the role sodium channel density plays in producing coordinated behavior. Genetic mosaics of *Swd* flies are created to localize the nerve or muscle foci that generate the mutant phenotype. Our results provide further insight into the molecular mechanisms and genetic interactions involved in seizures and ataxia in humans.

21 - Investigation into the mechanism of association of the BPTF PHD finger with the H3K4me3 modified nucleosome

Presenter: Thao Do

Major/Minor: Biomedical Engineering/French

Mentor: Catherine Musselman (Biochemistry)

- **Abstract:** In biology, most cell's genetic material is assembled into a nucleus which contains multiple long linear DNA organizing in a complex proteins such as histone to form chromosome. Nucleosome consists of eight core histone proteins (two copies of H2A, H2B, H3 and H4) encircle by ~142bp of DNA. There are many studies on the modification of a single histones tails and the interpretation of the combination of histones marks on the level of a peptide. Here, PHD finger of human BPTF is used to study how the histones interact with each other at the level of nucleosome recognition. A nucleosome with H3K4me3 modification on the histone tail will be created for the study of combination of BPTF PHD finger. Using Nuclear Magnetic Resonance (NMR), I will examine the association of recombinant nucleosome and will determine the nucleosome recognition outside a single histone tail.

22 - Development of Magnetic Mesoporous Silica Nanoparticles for Applications in Drug Delivery

Presenter: Steven Dominguez Jr.

Major: Biochemistry

Mentor: Sarah Larsen (Chemistry)

- **Abstract:** Mesoporous silica nanoparticles with iron oxide cores were synthesized and evaluated for use in the delivery of the chemotherapeutic drug, 5-fluorouracil (5-FU). The hypothesis is that these magnetic mesoporous silica nanoparticles can be tailored for application in the delivery of 5-FU. Magnetic iron oxide nanoparticles (~100 nm) were synthesized and a mesoporous silica shell were functionalized with (3-Aminopropyl)triethoxysilane (APTES) through a post synthesis grafting method. The samples were characterized using powder X-ray diffraction, nitrogen adsorption, transmission electron microscopy, and thermogravimetric analysis to determine the structure of the particles and properties such as pore volume (0.07 m³/g), surface area (540 m²/g), and functionalization (0.54 mmol/g). The magnetic mesoporous silica nanoparticles were loaded with 5-FU by adsorption of the drug in an acetone and a water solution. In a phosphate buffer, the loaded magnetic mesoporous silica nanoparticles were then evaluated for the release of 5-FU using UV-Vis Spectroscopy. Magnetic mesoporous silica nanoparticles are promising materials for drug delivery.

23 - Rescue of the Embryonic Lethality of mre-11(iow1) Mutants

Presenter: Sean Donlevy

Major/Minors: Biology/Psychology, Pre-Medicine

Mentor: Sarit Smolikove (Biology)

- **Abstract:** Meiosis is the process by which sexually reproductive organism produce gametes with halved ploidy. Production of functional gametes requires faithful segregation of chromosomes, which requires the formation of meiotic DNA double strand breaks (DSBs) and their repair by an error-free pathway termed homologous recombination (HR). Illegitimate repair of meiotic DSBs via error-prone pathways leads to aneuploidy gametes and, later, developmental diseases (e.g. Down's Syndrome) upon fertilization. Despite these severe effects, little is known about the genes involved in error-prone repair pathways. Our lab uses a model organism, *C. elegans*, to study genes involved in DSB repair pathways in meiosis. One gene, mre-11, codes for a protein (MRE-11) involved in a protein complex required for forming meiotic DSBs and repairing them via HR. Our lab has previously isolated a separation of function allele of the mre-11 gene, mre-11(iow1), which is proficient in forming meiotic DSBs but has defects in their repair via HR. Previous studies done in the lab show that repair of meiotic DSBs via one error-prone pathway, nonhomologous end joining (NHEJ), leads to various meiotic defects including aberrant oocyte chromosomal morphology and high embryonic lethality (due to aneuploidy gametes) in mre-11(iow1) mutants. However, removal of NHEJ in mre-11(iow1) mutants partially rescues these meiotic defects. From this, we reason that removal of genes involved in any error-prone repair pathway of DSBs can channel the repair of meiotic DSBs via HR in mre-11(iow1) mutants, thus providing a tool for investigating error-prone DSB repair pathways. If a gene is involved in error-prone repair of DSBs in mre-11(iow1) mutants, knocking it down by RNAi approach should reduce the defects observed in mre-11(iow1) mutants. 10% of the *C. elegans* genome has been screened, revealing some interesting candidate genes possibly involved in error-prone repair of DSBs.

24 - A Yeast Two Hybrid Screen for Identifying Interactions in C.elegans with MRE-11

Presenter: Katherine Dvorak

Major: Health and Human Physiology

Mentors: Sarit Smolikove & Robert Malone (Biology)

- **Abstract:** The Yeast Two Hybrid method is an assay for determining protein interactions in organisms. It is an interactional screen to detect physical interfaces. We are using this screen to look for interactions in the model organism *C.elegans* with the highly conserved set of meiotic proteins known as the MRX complex (including mre-11, spo11, rad51, and others). The interacting partners of MRE-11 are already known in other species, such as in *S.cerevisiae*. The goal of this project is to elucidate these interacting partners of this meiotic protein complex in *C.elegans* worms, and hopefully to identify homologs in other species. Currently, we have identified 10 physical interactions. Further tests of these genes in the *C. elegans* model system will need to be done to confirm these genes act in the MRE-11 pathway.

25 - Mental and Physical Discomfort in College Students: Pilot Data

Presenter: Emma Evanovich

Major/Minor: Psychology/Human Relations

Mentor: Mike O'Hara (Psychology)

- **Abstract:** The purpose of the study "Physical and Mental Discomfort in College Students" is to examine the construct validity of distress tolerance (DT), or the ability to withstand uncomfortable thoughts, feelings, and/or physical states. It is important in the field of psychology because DT has been found to be a contributing factor to the development and maintenance of many forms of psychopathology. DT is measured in a variety of different ways (e.g., through self-report measures, behavioral measures, and cognitive measures). This is a problem because it creates a multitude of different conceptualizations of DT throughout the research literature. Despite the importance of DT there is no established, unified theoretical model of the construct that incorporates the various conceptualizations proposed in the literature. The present study aims to organize and compare the various measures of DT in order to create a unified model of the construct. To achieve this aim, subjects will be completing 17 different measures of DT, including self-report measures and behavioral measures. This will allow us to examine DT within and across individuals and to determine the relationships between the various DT measures. We are currently in the data collecting stage for this study.

26 - Stuck in the Middle of Myself: Ideal vs. Actual Self

Competing Morals and Values in Person with Substance Abuse Disorders

Presenter: Timothy Fairbanks

Major: Sociology

Mentor: Steven Hitlin (Sociology)

- **Abstract:** This research is looking at whether a person who is identified as a substance abuser has different morals when using substances than they do when they are abstaining from use. Using a Rational Choice perspective this research assumes that the using self (real) and the abstaining self (ideal) each have a set of morals and that these two sets are competing. In order to examine whether this holds true persons admitted to local residential substance abuse treatment center were asked to fill out two sets of surveys each consisting of two surveys and including demographic information. Each set of surveys used an already established moral identity survey consisting of 5 morals deemed extrinsic, and 5 morals deemed intrinsic. The participants were asked to think about when they were using and abstaining separately and then to answer the moral identity questions. The survey was given at point of entry of treatment and exit of treatment in order to determine if treatment in this residential

setting had any effect. The findings showed that while treatment did not have a significant impact, a significant difference was shown between using and abstaining selves. This research could be used to construct future treatment modalities concerning competing values.

27 - The Effects of Novel Triazole Phosphonates on GGTase II and Related Enzymes

Presenter: Sarah Ferree

Major/Minor: Biology/Chemistry

Mentor: Sarah Holstein (Internal Medicine)

- **Abstract:** Multiple myeloma is characterized by the secretion of large amounts of protein by malignant plasma cells. The intracellular trafficking of these abnormal proteins is mediated by Rab proteins. Rab and related GTPase proteins are modified by attachment of a hydrocarbon tail causing localization to certain cellular membranes. This process, called prenylation, occurs through the action of three related enzymes, farnesyl transferase (FTase), geranylgeranyl transferase I (GGTase I) and geranylgeranyl transferase II (GGTase II). We have previously demonstrated that blocking Rab prenylation by GGTase II causes build-up of the abnormal protein and cell death in myeloma cells. Novel triazole phosphonate compounds were synthesized as potential GGTase II inhibitors. All novel agents were subjected to in vitro enzyme assays for GGTase II as well as the related prenyltransferases and IC50 values were obtained. The effects of the novel compounds on protein prenylation in cells were assessed via western blot analysis. Inhibition of GGTase II and related enzymes by novel triazole phosphonate compounds may prove an effective treatment option for multiple myeloma as well as other forms of cancer.

28 - Akirin and the Cellular Stress Response

Presenter: Kathryn Forneris

Majors: Health and Human Physiology, & Psychology

Mentor: Sarit Smolikove (Biology)

- **Abstract:** I am investigating chromosome behavior during the specialized cell division that produces sperm and egg cells (meiosis) in *C. elegans*. Prior to their segregation, chromosomes are physically linked by a protein complex called the synaptonemal complex(SC), which ensures the physical exchange of genetic information between chromosomes. In the absence of a functional SC, genetic information is not properly exchanged, resulting in the missegregation of chromosomes in cells that proceed to meiotic division. In humans, such errors can result in developmental disabilities, including Down Syndrome, Turner syndrome, and Klinefelter syndrome. Although it is known that a functional SC is crucial for successful chromosome segregation, the mechanisms pending its assembly and disassembly remains unknown. My project is centered on understanding how SC disassembly is regulated by the gene akirin in *C. elegans* and the interplay between its function and stress response pathways. Previous work has established that akirin prevents aggregation of SC proteins during meiosis. However, the mechanism by which akirin performs this function remains unclear. Preliminary data indicates that when akirin is not present, stress response pathways are activated and protein degradation is blocked. To address this, I am analyzing the interaction between akirin and proteins that function within stress response pathways.

29 - Synthesis of the Fluorescent Amino Acid ANAP

Presenter: Jessica Gilbert

Major/Minor Chemistry/Entrepreneurial Management

Mentors: Chris Ahern & Jason Galpin (Physiology)

- **Abstract:** L-3-(6-Acetylnaphthalen-2-ylamino)-2-aminopropanoic acid (ANAP) is a fluorescent amino acid that can be genetically incorporated into proteins. Our lab synthesized ANAP as part of a larger program to probe the structure and function of voltage-gated ion channels. This contribution describes the total synthesis of ANAP from an established protocol, and includes several modified procedures that were found to improve the yield and synthetic efficiency. Among the nine steps involved in the synthesis of ANAP are several reactions of note; hydroxy-demethylation of 1-(6-methoxy-2-naphthyl)-1-ethanone via reflux of concentrated hydrochloric acid, the preparation of ethyl α -(hydroxyimino)- β -bromopropanoate, and the preparation of the mild reducing agent, aluminum-mercury amalgam. High performance liquid chromatography was employed in the final purification of the sodium salt of ANAP. UV-spectroscopy and mass spectrometry were utilized for the characterization of the final product.

30 - Exploring the Binding Specificity, Thermodynamics and Structure of Tiam2 QM PDZ Domain

Presenter: Lisa Golden

Majors: Biochemistry & Chemistry

Mentor: Ernesto Fuentes (Biochemistry)

- **Abstract:** T-Cell lymphoma invasion and metastasis proteins, Tiam1/2, are guanine nucleotide exchange factors that activate the Rho GTPase Rac1, and serve an important role in cell adhesion, migration and neuronal growth and development. Both Tiam1 and Tiam2 contain several protein-protein interaction domains, including a PDZ domain. The PDZ domain is responsible for binding the C-terminus of other proteins to build scaffolding and signaling complexes. In previous experiments, four different residues in the Tiam1 PDZ domain were mutated to those found in the Tiam2 PDZ domain, resulting in a switch of binding specificity. Here, we describe the reciprocal experiment, where the same four residues in the Tiam2 PDZ domain were mutated to those in the Tiam1 PDZ domain (M978L, E979K, F982L and V987L). The binding specificity for several ligands of the Tiam2 PDZ quadruple mutant (QM) was determined by fluorescence anisotropy experiments using the C-termini of several ligands (e.g. syndecan1-4, Caspr4, neurexin1 and CADM1). The determined dissociation constants (Kd) showed that Tiam2 QM PDZ specificity was switched to that of the Tiam1 PDZ domain. Surprisingly, the Tiam2 QM PDZ bound syndecan ligands with higher affinity than the wild type Tiam1 PDZ domain. In order to understand the structural and dynamic basis for the Tiam2 QM PDZ domain specificity switch, we have begun structural analysis by NMR. We will present the backbone spectra of Tiam2 QM alone and in complex with syndecan1. Preliminary results indicate that several regions are dynamic to the extent that resonances are broadened beyond detection. To summarize, the quadruple mutant PDZ domain is able to switch the binding specificity of wild type Tiam2. The molecular basis for the increase in syndecan family binding affinity and dynamic properties will be studied through single and double mutant analysis.

31 - Tafazzin's role as an enzymatic modifier of the lipid phosphatidylserine: Determining the pathology of Barth Syndrome

Presenter(s): Michelle Gorecki

Major/Minor: Health and Human Physiology/French

Mentor: Matthew Gillum (Neurology)

- **Abstract:** Barth Syndrome is a serious, x-linked recessive disorder affecting males. Symptoms include cardiomyopathy, skeletal myopathy and muscle weakness, neutropenia, and growth delays. The known cause of Barth Syndrome is a deficiency of the enzyme tafazzin, which modifies the phospholipid cardiolipin. We believe tafazzin also modifies phosphatidylserine, based on a lipidomic screen of heart and muscle tissue from a mouse model of Barth Syndrome which revealed lower levels of phosphatidylserine compared to controls. We also found that tafazzin bound to phosphatidylserine that had been spotted on a membrane. Next steps will include radioactive experiments that will reveal modifications made by tafazzin in vitro. Determining the function of tafazzin is the next step in finding a cure for Barth Syndrome, beyond treating the individual symptoms.

32 - Egg Clutch Density and Maternal Contribution and Their Effect on Larval Fitness for the Walnut Fly, *Rhagoletis Suavis*

Presenter: Tanner Hallenstein

Major: Evolutionary Biology

Mentors: Amanda Nelson & Andrew Forbes (Biology)

- **Abstract:** The walnut husk fly, *Rhagoletis suavis*, has been shown to suffer high rates of larval mortality – the reason for which is poorly understood. Female *R. suavis* flies oviposit their eggs into walnut fruit which other females often superparasitize. The number of eggs in a single fruit can range from about ten to just over two hundred. Crowding within fruits may result in fitness costs to larvae. During oviposition, bacteria from the mother may transfer to the walnut fruit with unknown consequences for larval fitness. This study examined what egg clutch density larval fitness decreases and whether or not having the maternal contribution makes a difference in larval survival. Infested and non-infested walnuts were collected and egg clutches were removed, and then separated into specific quantities. Eggs were transplanted back into the parent fruit, as well as non-infested surrogate fruit. The fruit were checked regularly for emerging larvae. Larvae were recorded and stored for future eclosion. Larvae have survived in both parent and surrogate fruit, but so far have shown a high mortality rate from egg to pupal stage in both categories. Further statistical analyses will show if there are survival differences between treatments.

33 - Lipoprotein CrdB Propagates Envelope Stress Signals in *Myxococcus xanthus* through Both Two-Component System and Chemotactic-like Signaling

Presenter: Susanna Harris

Major/Minor: Microbiology/Spanish

Mentor: John Kirby (Microbiology)

- **Abstract:** The *crdA* gene encodes the protein CrdA, an NtrC-like transcriptional activator protein. CrdA is the output of the Che3 chemosensory system, a chemotaxis-like system controlling development, and the response regulator of a two-component system (TCS) with histidine kinase CrdS. CrdB acts as a sensor to relay a signal through both CrdS and the Che3 signal to CrdA. Our lab primarily focuses on signal transduction systems, and much of the work revolves around these two distinct, yet related, signaling pathways. We hypothesize that CrdA, in response to envelope stress signals perpetuated through these two systems, regulates the expression of genes encoding cellular envelope proteins and beta-lactamases. To test this hypothesis, this year we will perform epistasis testing on mutants in both the CrdSA TCS and the Che3 chemosensory system and will identify the regulon of CrdA through a transposon screen.

34 - A Closer Look at Reactivity Differences Between Nanoparticles and Surface Molecules

Presenter: Judy He

Major: Chemistry

Mentor: Sarah Mason (Chemistry)

- **Abstract:** Current inefficiencies with water purification pose an important environmental and health risk to the human race and challenges to fundamental chemical research. Prolonged exposure to common water contaminants such as sulfate can lead to severe and irreversible health problems. In recognition of this potential hazard, we seek to examine how aluminum oxide surfaces and a giant aluminum polycation, Al₃₀, can efficiently absorb sulfate, and thus, potentially be a more efficient and environmentally friendly filtration technique. Both mineral-water interfaces and nanoparticle geometries of aluminum hydroxides exist in nature, and our research methodology of quantum-based modeling can be applied to each of these systems. We have primarily focused on Al₃₀ and multiple alumina (α -Al₂O₃) surfaces. By using density functional theory (DFT) we model these structures to simulate real environmental interfaces in order to accurately observe the behavior of Al₃₀ and alumina when exposed to sulfate. By predicting reaction mechanisms and using DFT total energies, we are able to juxtapose and analyze the absorptivity of the outer-sphere models of Al₃₀ and Al₂O₃ when they are surrounded by sulfate ions. Our experimental modeling results have shown that Al₃₀ has a stronger absorptivity than Al₂O₃, which indicates that the latter is less efficient. It also shows that the alumina surface cannot properly model nanoparticle reactivity. By analysis and visualizing the electrostatic potential we plan to predict physisorption trends and explain why the nanoparticle is more reactive than the surface.

35 - Developing Physical Models for Nanoparticle-Enhanced Spectroscopy

Presenter: Thomas Heiderscheit

Major/Minor: Chemistry/Mathematics

Mentor: Amanda Haes (Chemistry)

- **Abstract:** Gold nanoparticles exhibit novel optical properties (i.e. localized surface plasmon resonance (LSPR) spectra) which depend on their shape, size, and local environment. One consequence of the LSPR results in spectroscopic detection of small molecules using surface-enhanced spectroscopies

including surface-enhanced Raman scattering (SERS). In this poster, a physical model is developed to study nanoparticle and 2-naphthalenethiol (2-NT) interactions based on changes in LSPR and SERS signal. The model is then applied to sample of varying analyte concentrations and nanoparticle sizes to assign time points for each model stage to observe extract kinetic and thermodynamic details.

36 - HFPK 334 An unusual Supernova Remnant in the Small Magellanic Cloud

Presenter: Kenny Heitritter

Majors: Physics, Astronomy, & Mathematics

Mentor: Randall McEntaffer (Physics and Astronomy)

- **Abstract:** We present new Australia Telescope Compact Array radio-continuum and XMM-Newton/Chandra X-ray Observatory observations of the unusual supernova remnant HFPK 334 in the Small Magellanic Cloud (SMC). The remnant follows a filled-in shell type morphology in the radio-continuum and has a size of 20 pc at the SMC distance. However, in X-rays we detect a prominent point source close to the center of the SNR exhibiting a spectrum with a best fit powerlaw of 2.7. The nature of this central point source is ambiguous though our analysis favors its association with the remnant. The high temperature, nonequilibrium conditions in the diffuse region suggest that this gas has been recently shocked and point toward a younger SNR with an age of less than 1800 years. With an average radio spectral index of -0.59 we find that an equipartition magnetic field for the remnant is ~ 0.00005 G, a value typical of younger SNRs in low density environments. Also, we report detection of scattered radio polarisation across the remnant at 20 cm, with a peak fractional polarisation level of 25%. We conclude that HFPK 334 is a young composite remnant with either a pulsar or compact central object.

37 - U-Pb ages of detrital zircons for the Dakota Formation, western Iowa and Eastern Nebraska: Evidence for a mid-Cretaceous transcontinental fluvial system

Presenter: Brittany Hendrix

Majors: Geoscience & Art History

Mentor: Emily Finzel (Earth and Environmental Science)

- **Abstract:** Fluvial deposits in the Dakota Formation of western Iowa and Eastern Nebraska are thought to be part of transcontinental fluvial system in the middle Cretaceous (Albian and Cenomanian). U/Pb age dating of detrital zircons (n=192) from sandstone bodies within the Dakota Formation was used to better determine provenance for this ancient river system. Age dates were derived by laser ablation (LA-ICPMS). Zircons from within the Dakota Formation show predominantly Appalachian (360-760Ma) and Grenvillian (1000-1300 Ma) age peaks. Based on this data, this study proposes that a transcontinental fluvial system with head waters in the southern and central Appalachian mountain range flowed west across the midcontinent into the Western Interior Seaway. Zircons from within the Dakota Formation are believed to be derived from material shed of the central and southern Appalachians and are likely not recycled from Paleozoic sediments in the midcontinent.

38 - Surface termination structure of α -Fe₂O₃(0001)

Presenter: John Herr

Majors: Chemistry & Math+Chemistry

Mentor: Sarah Mason (Chemistry)

- **Abstract:** Despite years of intense experimental and theoretical research, there is still an incomplete understanding of the surface termination for α -Fe₂O₃(0001), a prevalent face of the mineral oxide hematite. Owing to the inextricable link between structure and reactivity, an improved understanding of the surface of hematite would lead to a better understanding of its interactions in the environment and for other technical applications. In our study hematite was modeled by density functional theory (DFT) calculations along with the methodology termed ab initio thermodynamics which allows comparison of the stability of surfaces which are not otherwise directly comparable. Previous results have shown that out of three possible surface terminations for α -Fe₂O₃(0001), two of them are equally stable under ambient atmospheric and temperature conditions, yet other results still don't quite match experimental data. We have proposed several "defect" terminations which result in combinations of these two stable surface models and compared our data to experimental data for α -Fe₂O₃(0001) which yielded good agreement between theory and experiment. Furthermore our results show that the preparation conditions may play an important role in the resulting structure of the surface. In future work we will model the reactivity of these surfaces toward environmental contaminants such as arsenic.

39 - Origin of Garnet Amphibolites from the Marianas Forearc

Presenter: Luan Heywood

Majors: Earth and Environmental Sciences, Physics, & Mathematics

Mentors: Mark Reagan (Earth and Environmental Sciences)

- **Abstract:** The goal of this ongoing research is to develop understanding of the early geological evolution of the southern part of the Izu-Bonin-Marianas (IBM) subduction zone, by studying early subduction related rocks from the IBM arc collected during Shinkai 6500 submersible diving. Our ongoing work aims to analyze the isotopic compositions of hornblende and garnet extracted from a garnet amphibolite that was found by submersible diving upslope of the Challenger Deep in the Marianas Trench. By examining this and chemical, spatial and temporal relationships with other rocks, we obtain age information that helps us develop new interpretations of the tectonic evolution of the southern IBM. / / This rock is interesting because its origins are very unclear: as an anomalously high pressure metamorphosed crustal rock located in exposed mantle rocks in the Marianas forearc, it could be from the overlying Philippine Sea Plate, the subducting Pacific Plate, or from faraway, carried by mantle convection. Trace elemental composition of the rock indicates a mid-ocean ridge basalt like origin. Ar-Ar geochronology indicates a 25 ma cooling age, which coincides with a time of massive tectonic upheaval in the area. We hope that current work will elucidate its ultimate origin in time and in space.

40 - Characterizing the Binding Affinity of the Tiam1-Talin Complex

Presenter: Frances Hindt

Major: Biochemistry/Spanish

Mentor: Ernesto Fuentes (Biochemistry)

- **Abstract:** The T-cell lymphoma invasion and metastasis gene 1 (Tiam1) is a guanine nucleotide exchange factor (GEF) that regulates the Rho-family guanine triphosphatase (GTPase) Rac1. Tiam1 is important for several essential cellular processes, such as cell migration, adhesion, and polarity. Tiam1 has been identified to interact with cytoskeletal protein Talin. The Tiam1-Talin interaction has been shown to be essential in Rac1 activation and migration of cells, as well as involved in regulating focal adhesion turnover. / / The N-terminal FERM domain of Talin contains three subdomains - F1, F2, and F3. In order to explore the dynamic and structural properties of the Talin-Tiam1 interaction, HIS- and GST-tagged vectors containing Talin F1F2F3, F2F3, and F3 subdomains were produced. The GST-tagged constructs of the Talin FERM subdomains were purified and used in pull-down assays with the Tiam1 PH-PH domain fragment. The results of multiple pull-down assays showed that Tiam1 PH-PH domains bound to Talin F2F3 and F3 of the FERM domain, confirming the Taim1-Talin interaction in vitro. Ongoing ITC experiments are being used to quantify the binding affinity and determine the thermodynamic properties of the Tiam1-Talin interaction. These methods will ultimately be used to identify the minimal fragment of Tiam1 that binds Talin, which will be used to guide future structural and cell biological studies.

41 - Biomolecular Recognition of Neuronal Sodium Channel NaV1.2 by Calmodulin

Presenter: Liam Hovey

Majors/Minor: Physics & Chemistry/Mathematics

Mentor: Madeline Shea (Biochemistry)

- **Abstract:** Calmodulin (CaM) is an essential, eukaryotic calcium sensor that regulates the inactivation of the neuronal voltage-gated sodium channel (NaV1.2) by binding to an IQ motif [IQxxΦBGΦxxB, where F is aromatic, and B is basic] that is embedded in the C-terminal tail of the channel and an inactivation gate near the plasma membrane. The major goal of this study was to understand how calcium triggers a change in the interface between CaM and the ion channel to regulate inactivation. We undertook mutational perturbation based on our solution structure (2KXW) of the C-domain of apo-CaM bound to the helical IQ motif of NaV1.2. Energetic contributions of these residues were tested by monitoring changes in CaM binding to alanine-substituted biosensors containing the NaV1.2 IQ motif bracketed by a pair of auto-fluorescent proteins (YFP, CFP); CaM binding disrupts FRET in proportion to fractional saturation. While mutations in the IQ motif lowered its affinity for calcium-saturated CaM, larger changes were seen for apo CaM. Our new solution NMR structure of the open C-domain of calcium-saturated CaM bound to the IQ motif of NaV1.2 is the first example of apo and Ca²⁺-saturated CaM bound to the same IQ motif and explains the large energetic differences.

42 - Evaluation of a Modified Paleolithic Dietary Intervention in the Treatment of Relapsing-Remitting Multiple Sclerosis

Presenter: Amanda Irish

Major/Minor: Health and Human Physiology/Pre-Medicine

Mentors: Warren Darling (Health and Human Physiology) & Terry Wahls (Internal Medicine)

- **Abstract:** Multiple Sclerosis (MS) is a progressive disease where the body's immune system mistakenly recognizes portions of the central nervous system as foreign and attempts to destroy them. It can cause vision and memory loss, pain, paralysis, and even death. An estimated 8,500 Iowans are

affected. Disease-modifying drugs are typically prescribed to reduce or prevent future disability with limited benefit and serious side effects. Dietary modifications are not typically prescribed unless needed for other co-occurring disease(s). / / Improvements in fatigue and quality of life have been seen in MS patients adhering to a modified Paleolithic dietary intervention (MPDI) in combination with other non-conventional therapies. However, no research has been conducted evaluating effects of the dietary intervention alone. / / To evaluate the MPDI for treatment of Relapsing-Remitting MS (RRMS), we are observing 20 men and women with neurologist-verified RRMS: one-half randomized to a “usual care” (control) group; the other half taught the MPDI.

43 - Annexin V acts locally on fibrosarcoma growth by blocking phosphatidylserine

Presenter: Mitchell Kent

Major: Biomedical Engineering

Mentor: Joel Shilyansky (Pediatric Surgery)

- **Abstract:** Introduction: Phosphatidylserine (PS) is a cell membrane phospholipid that commonly externalized by apoptotic cells. Live fibrosarcoma cells have been also found to present PS on the cell surface. The goal of the current study was to determine the effect of recombinant Annexin V (AnV), which binds to PS, on tumor growth. Materials and Methods: CMS-5 fibrosarcoma cells (10⁶) tumors were injected into both flanks of Balb/c mice. Once tumors were palpable, Mice were treated with peritumoral injection of recombinant AnV on the right flank only. Tumor growth was compared. Results: Tumors treated with AnV grew slower than tumors treated with control protein. Moreover, tumors on the treated side (1.01 cm³) grew significantly slower than tumors on the untreated flank (mean size=1.62 cm³, p<0.05). Conclusion: We demonstrated that peritumoral AnV treatment slows local tumor growth without affecting distal tumor growth. The findings suggest that PS alters the tumor microenvironment and promotes tumor growth.

44 - Examining the effects of fluid shear stress on cells through micropipette aspiration

Presenter: Benjamin Krog

Major: Biomedical Engineering

Mentor: Michael Henry (Molecular Physiology and Biophysics)

- **Abstract:** Cancer cells traveling to distant tissues during metastasis must survive passing through the circulation. The influence of the circulatory fluid microenvironment on these cells is poorly understood. It has been suggested that exposure to the shear forces within circulation was inhospitable to cancer cells, causing the cells to be destroyed. Recent evidence from our lab indicates that transformed cells selectively adapt following exposure to fluid shear forces and become resistant to subsequent exposures to shear force. These cells survive forces in excess of that may be experienced within circulation. However, the mechanism behind this induced resistance is unknown. Through micropipette aspiration, a technique used to measure mechanical properties of cells, we are able to examine changes in cells under various conditions, including fluid shear stress. One such mechanical property we evaluated is the elastic modulus. The elastic modulus of cells, a measure of stiffness, is altered upon exposure to fluid shear stress. We are currently investigating the role of membrane stiffening in the fluid shear resistance response in cancer cells.

45 - Breaking the Cycle: Meth in the Heartland

Presenter: Katherine Kuntz

Majors/Minor: Economics & Journalism and Mass Communication/ Philosophy

Mentor: Charles Munro (Journalism and Mass Communication)

- **Abstract:** My research is part of an investigative documentary I am working on as part of an honors thesis through the journalism program, with the ICRU fellowship and as a student reporter for IowaWatch, the Iowa center for public affairs journalism. My documentary is tentatively titled, "Breaking the Cycle," which is an investigation into the current climate of meth use in Iowa and the cycle of addiction that consumes individuals but also families and sometimes whole communities. This research is centered on the serious impacts on children who are raised in homes where meth is used by a parent, generally the mother, and the increased risks those children face of becoming addicts themselves. My documentary aims to fully portray the realities of meth use in homes, and the often overlooked realities of the drug throughout Iowa. I also investigate and document the current policies geared towards breaking addictions and increasing the welfare of Iowa children. The completed documentary is scheduled to air on Iowa Public Television in April, 2014.

46 - Measuring nanosecond-scale carrier lifetimes in semiconductor nanowires

Presenter: Max Lassise

Major: Physics

Mentor: John Prineas (Physics)

- **Abstract:** Minority carrier lifetimes play an important role in determining the efficiency of optoelectronic devices, particularly in solar cells. In Gallium-Arsenide nanowires, carrier lifetimes have been measured to be extremely short, with the best wires demonstrating lifetimes of just over 1 nanosecond. This leaves little room for error in the growth and analysis of the wires. Our goal in this study is to grow GaAs nanowires with superior electrical characteristics and then measure the carrier lifetimes in the wires. With these measurements we should be able to find where the carriers are recombining, giving us an idea of where the defects are located within the crystal.

47 - An Investigation Into the Oxidative Coupling of Naphthols

Presenter: Alvin LeGall

Majors: Biochemistry & Pharmacy

Mentor: Horacio Olivo (Natural Products Chemistry- Pharmacy)

- **Abstract:** The seeds found in the fruit growing in Southwestern Texas known as 'coyotillo' or 'tullidora' possess toxic natural products which cause toxicity in both humans and animals. The scientific name of this plant is *Karwinskia humboldtiana*. Interestingly a dimeric dihydroxyanthracenone was found to have unique cytotoxicity for liver, lung, and colon cancer cells, and much less selectivity for these types of normal cells. Due to the relatively low yield of the isolated T-514 compound we have turned to the total synthesis of the T-514 in order to obtain greater yields and to conduct more studies on the compound. We envision a synthetic strategy that consists of the oxidative coupling of two dihydroxyanthracenones to prepare T-514. These naphthols bear structural resemblance to the compound of interest and they should couple the same way. This synthetic strategy will also allow us to prepare not only this natural product but also other *Karwinskia*-like natural products.

48 - Defining the Pediatric Procedural Anxiety Phenotype Across a Two Phase Study

Presenter: Jessica Lewandoski

Major/Minor: Nursing/Spanish

Mentor: Anne Ersig (Nursing)

- **Abstract:** Clearly defining a phenotype of interest is fundamental to understanding genotype-phenotype associations. While existing research underscores the importance of explicitly defining phenotypes, little is known about overcoming the challenge of defining behavioral and trait phenotypes. This study aims to explicitly define a phenotype of pediatric procedural anxiety. /This is a secondary analysis of data from a two-phase study of children (n=1124) having a painful medical procedure. Due to data mining, the second phase contains fewer items to evaluate procedural anxiety. This offers a unique challenge in phenotype definition due to inconsistency across phases. Questions assessing procedural anxiety in the two study phases were compared. Statistical approaches examining variance attributable to each question, principal components analysis, and factor analysis, were used. Ultimately, by explicitly defining behavioral and trait phenotypes, we can better identify biological, psychological, and social factors associated with these outcomes. To improve clinical care and research, nurses must be able to clearly describe patients' conditions, especially when presented with potentially ambiguous behavioral phenotypes like anxiety.

49 - Dosimetric comparison of 3D and 4D-weighted dose calculation for stereotactic body radiation therapy in lung tumors

Presenter: Mingyu Ma

Majors: Physics, Computer Science, & Math

Mentor: Junyi Xia (Radiation Oncology)

- **Abstract:** Conventionally, 3D dose calculation is used to treat lung tumors in body radiation therapy. However, 3D dose is calculated based on only one CT graph, the breath-hold CT. It may not be very accurate potentially since the tumor moves with our breathing movement of the lung. An alternative solution is using 4D dose calculation. In contrast to 3D Dose, which is calculated using one CT, 4D dose is calculated using 10 CTs. It is expected to be more close to reality since it takes into account of the tumor motion within respiration cycles. This works is to investigate the dosimetric impact on tumors and normal lungs between 3D and 4D-weighted dose calculation.

50 - The D24Y mutation in actin alters actomyosin function: insight into aortic disease in pregnancy

Presenter: Sarah Mayer

Majors: Biochemistry & Spanish

Mentor: Heather Bartlett (Biochemistry)

- **Abstract:** Mutations in alpha smooth muscle actin cause an autosomal dominant syndrome of vascular disease. In particular, aortic dissection during pregnancy has been traced to the actin mutation D24Y, though its mechanism is unknown. Residue 24 is located at the myosin binding site, and previous studies have implicated the negatively charged aspartates at residues 24 and 25 in the weak

interaction of actin with myosin. We hypothesize that the mutation D24Y disrupts actomyosin interaction. Our hypothesis is further supported by the fact that mutations affecting smooth muscle myosin similarly cause aortic dissection in pregnancy. To test this hypothesis, we studied morphology and movement of 1) mitochondria, which are dependent on actomyosin function, and 2) the actin cytoskeleton in *S. cerevisiae*. Time lapse imaging was performed on yeast cells expressing D24Y-mutant actin. Mitochondria were tagged with a fluorescent protein and the morphology and movement was quantified as a measure of actomyosin function. The morphology and movement of actin filaments were assessed. Compared to wild type, D24Y strains exhibited decreased velocity of mitochondria transport from mother to bud cell. D24Y mutants displayed fewer actin cables extending from the mother cell to the bud and slower velocity of filament movement. The delay in transport may account for the slow growth of cells expressing D24Y mutant actin, which have a doubling time twice that of wild type cells. Together, the data support that the D24Y mutation has a deleterious effect on actomyosin interaction. Further studies on D24Y mutant actin binding of myosin and motility are underway but these preliminary findings may suggest a basis for human disease. Delayed cellular transport and growth may slow the adaptive response to the marked increase in blood volume that occurs with pregnancy.

51 - Complementary Hydrogen Bonded Templates and their Crystal Packing

Presenter: Nam Nguyen

Major: Chemistry

Mentor: Leonard MacGillivray (Chemistry)

- **Abstract:** Templates provide a means to assemble reactants for chemical reactions. A fundamental feature of template systems encountered in biology is the capability of complementary templates to assemble (e.g. DNA Helix). Our group utilizes organic and inorganic templates to direct photostable olefins into photoreactive geometries in the solid state. The organic template system operates through hydrogen bonding between the template and olefin. The templates can function as either hydrogen bond donors (e.g. 1,3-dihydroxyl benzene), or the hydrogen bond acceptors (e.g. 1,8 bis(4-pyridyl) naphthalene). Both types of templates exhibit similar geometries in order to direct the [2+2] photodimerization in the solid state. With this in mind, we hypothesized the ability to cocrystallize two different templates to form discrete hydrogen-bonded structures. In this poster we will present our findings on the cocrystallization of hydrogen bond donor and acceptor templates to form complementary assemblies in the solid state and the effect of varied functionality on the crystal packing. Discussions on the crystal structures and local packing will be reported.

52 - Neonatal Outcomes following Prolonged Premature Rupture of Membranes (≥ 1 Week) Prior to 24 Weeks Gestation

Presenter: Emily O'Brien

Major: Health and Human Physiology

Mentors: Jane Brumbaugh & Edward Bell (Pediatrics: Neonatology)

- **Abstract:** Background: Prolonged premature rupture of membranes (PPROM) before 24 weeks gestation was associated with high mortality in the 1990s (35-55%). Aggressive use of high frequency ventilation, nitric oxide, and surfactant may have improved survival for preterm infants affected by PPRM. Objective: To measure survival and pulmonary morbidities, including chronic lung disease,

pulmonary hypertension, and air leak syndrome, following preterm birth complicated by PPRM. Methods: A retrospective case-control analysis of 184 inborn infants (63 cases, 121 controls) born between 2002 and 2011 at a tertiary care facility with a level 4 neonatal intensive care unit was performed. Mothers of cases experienced ≥ 1 week of ruptured membranes prior to 24 weeks gestation (Mean duration = 6.80 ± 4.29 weeks). Mothers of controls experienced < 24 hours of ruptured membranes. Cases were matched consecutively 1:2 with controls for gestational age at birth (± 1 week), sex, and antenatal corticosteroid exposure. Results: Despite PPRM before 24 weeks gestation, there was no difference in survival between cases (89%) and controls (93%, $p=0.40$). However, pulmonary hypoplasia was identified in nearly half of cases (49%) versus 1% of controls ($p<0.001$), pulmonary hypertension was present in 29% of cases compared to 5% of controls ($p<0.001$), and air leak occurred in 22% of cases versus 3% of controls ($p<0.001$). High frequency ventilation was used more often in cases (78%) than controls (54%, $p=0.002$) as were surfactant (cases 92%, controls 78%, $p=0.006$) and nitric oxide (cases 43%, controls 14%, $p=0.001$). Chronic lung disease was common in both cases (73%) and controls (63%, $p=0.18$). Conclusion: There was no significant difference in survival of preterm infants with membranes ruptured ≥ 1 week prior to 24 weeks gestation and preterm infants with membranes ruptured < 24 hours when matched for gestational age at birth. However, significant pulmonary morbidities and intensive medical care were more common following PPRM. In the era of high frequency ventilation, nitric oxide, and surfactant, we speculate that the use of these respiratory therapies may have improved survival following high-risk PPRM, and we recommend that antenatal counseling include current center-specific survival data.

53 - Why Isn't Arts Funding Any Fun?

Presenter: Alysa Olson

Major/Minor: Vocal Performance/Performing Arts Entrepreneurship

Mentors: Andrew Willard (Honors Program)

- **Abstract:** This past summer I was an administrative intern with The Performing Arts Project (TPAP) in Winston-Salem, North Carolina from June 29-July 21. In addition to the daily administrative tasks, I did research on possible grants for which TPAP was eligible to apply as well as taking stock of the general grant environment for performing arts nonprofit organizations. I did research online about various grants and funding resources available in the nonprofit arts/arts education world. I analyzed the requirements of funding organizations and how these requirements were restrictive and difficult to achieve. I also discussed the challenges of the securing grants with my TPAP supervisors. I achieved email correspondence with one nonprofit organization about the qualities they look for when considering grant applicants to add a different perspective. I summarized the grant opportunities for which TPAP could apply and this document helped create documents for TPAP's Board of Directors meeting. From this research, I discussed appropriate courses of action for future funding as well as commenting and critiquing the larger picture of national arts funding in America.

54 - Paleoenvironmental conditions at the Oligocene-Miocene boundary in Sumatra, Indonesia: Environmental template for the evolution and dispersal of Primates in Island Southeast Asia

Presenter: Natalie O'Shea

Major/Minor: Anthropology/Geoscience

Mentors: Art Bettis (Geoscience) & Russell Ciochon (Anthropology)

- Abstract:** Changing habitat availability combined with global and regional fluctuations in temperature and rainfall played an important role in how and why primates radiated into Southeast Asia. Little is known about this tectonically active region where much of the land area formed after the radiation of higher primates began in earnest about 23 million years ago, during the Oligocene. A stratified sequence of ancient soils, or paleosols, from the Oligocene-Miocene boundary in Sumatra provides a localized record of environmental changes as significant land areas emerged and joined with the Asian mainland. In this study, preliminary interpretations of changing environmental conditions during this critical time period based on morphological, geochemical and isotopic studies of the paleosol sequence indicate a mosaic of local environmental conditions in the lower reaches of a large river system. Our data suggest a persistently wet rainforest environment, an environment favorable to the dispersal of primates.

55 - Effects of meiotic drive on chromosomal differences between two sister species of *Drosophila*

Presenter: Dzavid Pandzic

Majors/Minor: Neurobiology & Human Physiology/Chemistry

Mentor: Bryant McAllister (Biology)

- Abstract:** A factor that can influence the probability of fixation of a new chromosomal variant and potentially contribute to speciation is meiotic drive. Meiotic drive describes an unequal representation of alleles among the gametes of an individual as a consequence of the mechanics of meiotic divisions. Preliminary results have shown a 56% transmission bias for a derived fused X-4 chromosomal arrangement versus the ancestral unfused X and 4th arrangements in female *Drosophila americana*. However differences other than the centromeric arrangement of the fused and unfused chromosomes could be responsible for the observed transmission bias including inversion Xc, which in *D. americana* is only present on the fused X-4 arrangement. This experiment focused on discerning whether a transmission bias is observed between chromosomes that differ in centromere arrangement but share the Xc chromosomal inversion. This was accomplished by crossing *D. americana* with *Drosophila novamexicana* to create a hybrid that was homozygous for the Xc inversion but heterozygous for the X-4 fusion. Upon measuring the transmission of the X-4 fusion in hybrid females to male offspring, results showed a 57% bias in favor of the fused X-4 arrangement. The transmission bias persisted despite both arrangements being homozygous for the Xc inversion, suggesting that centromere arrangement, and not the Xc inversion, is a target of meiotic drive of differing chromosomal forms in *D. americana*.

56 - The Effects of Cytokinin on Apogamy in *Ceratopteris richardii*

Presenter: Dzevida Pandzic

Major/Minor: Biology/Chemistry

Mentors: Chi-Lien Cheng & Erin Irish (Biology)

- Abstract:** All land plants proceed through a life cycle in which a haploid gametophyte generation alternates with a diploid sporophyte generation. The sporophyte generation produces spores, which are the first cells of the gametophyte generations, by meiosis. The gametophyte generation produces gametes by mitosis. The fusion of male and female gametes (syngamy) produces the zygote, the first cell of the sporophyte generation, and completes the life cycle. In addition to this sexual reproduction pathway, some fern species can undergo apogamy, a process by which the gametophytes bypass

fertilization to generate haploid sporophytes. The model fern *Ceratopteris richardii* does not reproduce asexually through apogamy in nature, but apogamy can be induced in the laboratory by altering glucose levels in the medium. I discovered that the plant hormone cytokinin can also induce apogamy. In gametophytes undergoing apogamy, callus formation and gametophyte regeneration were also observed. It was discovered that the ratio of apogamous sporophytes to calli and gametophytes changed in response to the concentration of cytokinin in the media. In angiosperms cytokinin is known to activate the transcription of *WOX9* gene whose activity is essential to maintain the meristem fate. Here, I identified a new role of cytokinin signaling network- inducing the asexual pathway of apogamy in the fern.

57- Synthesis of Core-Shell Iron Oxide-Mesoporous Silica

Nanocomposites

Presenter: Connor Parker

Major/Minor Microbiology/Chemistry

Mentor: Sarah Larsen (Chemistry)

- **Abstract:** The synthesis and application of iron oxide-mesoporous silica nanocomposites has emerged as a heavily researched area. The combination of both of these materials' properties results in a nanoparticle (particle with a dimension less than 100 nm) with many potential applications in areas such as environmental remediation, drug delivery, and biomedical imaging.. Previously reported synthetic methods have resulted in small yields due to dilute synthesis conditions. In this study, synthesis methods were utilized to create discrete, dispersed, iron oxide-mesoporous silica core-shell nanoparticles in multi gram scale yields. These results represent an advancement towards the production of high yield, sub-100 nanometer particles with high surface area and controllable size, using simple synthesis methods.

58 - The Effect of GFP on Ciliary Motor

Presenter: Tyler Pecora

Major: Biology

Mentor: Daniel Eberl (Biology)

- **Abstract:** My project involves manipulating factors that control ciliary motility in auditory neurons. Specifically I am building a DNA construct that fuses the GFP protein with an axonemal dynein. The dynein we are investigating (CG17150) is responsible for the development of antenna in fruit flies, and ultimately the fruit flies hearing.

59 - Aborigines' Dreaming or Britain's Terra Nullius: Perceptions of Land Use in Colonial Australia

Presenter: Emily Pettit

Majors/Minor: History & Geography/ Sustainability

Mentor: Jacki Rand (History)

- **Abstract:** I am researching the differences between Aboriginal Australian and colonial British perceptions of the Australian landscape in order to understand how Britain's arrival in Australia led to

severe environmental degradation. Aborigines incorporated the landscape into their creation story and spiritual beliefs because they understood that the environment provided food, shelter, water, and other necessary resources. To damage the landscape was to sever the connection with one's ancestors and ruin the source of food and shelter. Aborigine land management practices focused on procuring needed resources while allowing ecosystems to recover for future use. British colonists, in particular aristocratic officials and farmers, saw Australia as an empty continent, or "Terra Nullius," ready for commercial exploitation. British land policy in Australia connected property ownership, a legal definition, with an assumption of civilized superiority over the Aborigines. Because Britain needed natural resources, the Australian colonies focused on immediate commercial profits without considering long-term ecological degradation. Australia today is facing serious environmental issues stemming from commercial agricultural practices first used by British farmers. Irrigation and single-crop monocultures have led to pollution, erosion, and degraded water resources that threaten both agricultural and environmental vitality.

60 - Role of Perceptual Variability on Children's Executive Functions

Presenter: Daniel Plebanek

Majors/Minor: Psychology & Linguistics/Spanish

Mentor: Sammy Perone & Larissa Samuelson (Psychology)

- **Abstract:** Executive function is a term that describes a set of processes composed of working memory, inhibition, and task switching. These processes work together to plan and carry out actions. These processes undergo dramatic change between the ages of 3 and 5 years. A canonical measure of executive function during early development is the dimensional change card sort (DCCS) task. This task requires children to sort bi-dimensional cards by one rule and then switch to a new sorting rule. For example, children may first be told to sort cards by their color, before being told to sort by shape. Traditionally, 3-year-olds are unable to pass the task while 4- and 5-year-olds are able to flexibly switch rules. The present study investigates how dimensional labels (i.e., 'color') and differences in the perceptual features of the cards affect children's ability to flexibly switch rules. The results of this study have shown that the presence of labels helps children switch rules.

61 - Positional Identity: Defining Oneself in Terms of Others

Presenter: Rachel Revelez

Major: Elementary Education

Mentor: Renita Schmidt (Education)

- **Abstract:** The Strong Girls Read Strong Books Book Club is a qualitative research project developed by Drs. Renita Schmidt and Amanda Haertling-Thein. Our research team meets for two hours each week with 50 ethnically and socioeconomically diverse fourth-, fifth-, and sixth-grade girls to explore what it means to be strong girls. During the book club, participants read and discuss literature and other important life issues and respond in a variety of other ways. Our goals are to build literacy confidence in girls and provide a space for them to encounter a variety of perspectives about what it means to be a strong girl in today's society. In this work we consider many research questions, including: How does identity, particularly that of young girls, form and develop in various situations and how does that then influence the response elicited by these girls?

62 - Interpreting Past Climates in Volcanic Settings: Laguna Lejia, Chile

Presenter: Samuel Saltzman

Major: Geoscience

Mentor: Ingrid Ukstins Peate (Geoscience) & Richard Baker (Math)

- **Abstract:** Geologic records of past climate can help us interpret current and future change of the Earth's climate. Lakeshore deposits of Laguna Lejia, Chile, (23°30'S 67°42'W) provide a record of sedimentation over the last 20,000 years. Sediments deposited from the lake are carbonates and include tufa, porous laminated carbonate, stromatoliths, organically mediated laminated carbonate, carbonate tubes, reworked volcanic sandstones and siltstones, and ash weathered to clay. Samples were divided into four stratigraphic units based on sediment type and structure. The first unit is organically dominated with interbedded volcanic deposits, the second consists of finely laminated clay and siltstones with occurrences of carbonates, the third is distinguished by a blocky texture, and the fourth is shale. Major and trace element analysis revealed two distinct groupings: one with high arsenic (342+/- 24ppm) and magnesium (10865+/-639ppm), the other with low arsenic (44+/-26ppm) and magnesium (5781+/-992ppm). All low Mg-Ar samples showed iron staining or anomalous discoloration. This suggests that iron oxy-hydroxide coprecipitation may be influencing arsenic concentrations. Further research including SEM imaging and high precision isotope, major, and trace element geochemistry will be conducted to investigate this and its impact to our interpretation of the regions paleoclimate.

63 - Investigating opioid-induced antinociceptive pathways through assessment of protein transcript levels in the brain of rats with chronic inflammatory pain

Presenter: Christopher Sande

Major: Biology

Mentor: Anne-Sophie Wattiez (Anesthesia)

- **Abstract:** Morphine is a very commonly prescribed drug in the treatment of pain, and its action mainly involves the mu opioid receptor (MOR). The rostral ventromedial medulla (RVM) is a nucleus in the brain, which relays information from the superior nucleus to the spinal cord. The RVM is especially important because both inhibitory and facilitatory pathways originate from it, and the balance of these inputs influences the level of pain the patient feels. Morphine injected into the RVM has no effect on nociception in naïve rats, but can inhibit nociception in rats with chronic pain. This difference in response may involve changes that occur after the onset of chronic inflammatory pain that affect the types of proteins binding to MORs. Usually MORs bind to the protein Galphai/o. We hypothesize that chronic pain conditions change protein expression so that MORs bind to a different Galpha protein. By using an RT-qPCR technique, we are assessing and comparing the levels of different Galpha proteins in the RVM of rats with chronic compared to control animals.

64 - Sleep abnormalities in a Drosophila knock-in model of human generalized epilepsy with febrile seizures plus (GEFS+)

Presenter: Grant Shivers

Major: Genetics and Biotechnology

Mentor: Toshihiro Kitamoto (Anesthesia)

- **Abstract:** Voltage-gated sodium channels (VGSCs) are responsible for generation and propagation of the action potentials in nerve cells or neurons. Perturbations of VGSC activity lead to alteration of firing properties of neurons, which significantly modifies neural functions and therefore behaviors. We are particularly interested in how regulation of sleep is affected by dysfunction of VGSCs. Generalized epilepsy with febrile seizures plus (GEFS+) is a common childhood-onset genetic epilepsy syndrome, which is often caused by a mutation in the human VGSC gene SCN1A. Recently Sun et al. (2012) generated a transgenic fruit fly carrying a disease-causing GEFS+ mutation in the fly VGSC gene and found that the mutation causes a semidominant temperature-sensitive seizure similar to the phenotype observed in human GEFS+ patients. This fly strain provides a unique opportunity to study the effects of the GEFS+ mutation on sleep regulation under strictly controlled genetic and environmental conditions. Here we report our preliminary results of the analysis.

65 - A Historical Perspective on Humanitarianism in Action: Witnessing and Responsibility in Doctors Without Borders

Presenter: Lauren Sillman

Majors/Minor: History & English/Global Health

Mentor: Paul Greenough (History)

- **Abstract:** The International Committee of the Red Cross, the original medical humanitarian organization, was formed in response to tragedy and suffering, positing human dignity and medical care in the face of war and destruction. That organization and thousands of humanitarian organizations since are assertions that good action in the interests of humanity, rather than in the interests of political, economic, or social institutions, may be possible. As aid organizations have proliferated, however, it has also become clear that aid, whether in the form of developmental schemes or emergency relief, can be futile or even destructive. Hastily planned or ideologically rooted projects in the name of "progress" often do more harm than good. Doctors Without Borders was born from the Red Cross and has played an important role in international discourse on the role of humanitarian work. My research has focused on their work in Afghanistan, Bosnia and Syria, utilizing newspaper archives, publications about the organization written by observers and by members themselves, and official government and NGO records. A historical perspective has allowed for an analysis of Doctors Without Borders' decision-making process and the perceptions of a global audience over time, in different international climates. A number of recurrent tensions have emerged that have played out differently in unique situations. For example, their role as a witness to systemic and incidental violence has been especially mutable. Visibility is essential to publication and funding of projects, but the notion of an ideal level of notoriety is hardly straightforward.

66 - Shakespeare auf Deutsch: Context and Translations

Presenter: Brandon Sleik

Majors/Minor: English & German/International Business

Mentor: Adam Hooks (English)

- **Abstract:** Shakespeare's plays have been produced in Germany since the 1604 when Romeo and Juliet premiered in Nordlingen, Bayern. However, it was not until the 18th Century that Germany would have the Schlegel-Tieck translations of Shakespeare's dramatic works, which continue to serve as the

paradigm for study of Shakespeare in the German language. This study aims to introduce the Schlegel-Tieck translations while examining the differences in word-for-word translations of plays and sonnets, as well as serve as an introduction of Shakespeare's impact on German history, culture, and literature.

67 - Transposon Mutagenesis Identifies Genes Involved in *Myxococcus xanthus* Predation of *Bacillus subtilis*

Presenter: Sarah Strack

Major/Minors: Microbiology/Chemistry & Theatre Arts

Mentor: John Kirby (Microbiology)

- **Abstract:** *Myxococcus xanthus* and *Bacillus subtilis* are soil-residing bacteria that display complex behavior in response to starvation leading to the formation of spores. Additionally, *M. xanthus* is a microbial predator able to consume a broad range of prey. Direct cell contact, motility, and the secretion of lytic enzymes and secondary metabolites are all required for efficient predation by *M. xanthus*. *Bacillus subtilis* likely shares the same habitat and likely encounters *M. xanthus*, yet is not known for any predatory behavior. *B. subtilis* has been characterized for its production of many bioactive molecules. We have determined that *B. subtilis* is capable of defending itself from predation by *M. xanthus*. To identify genes involved in this process, we performed transposon mutagenesis of *M. xanthus* and assayed the resulting mutants for their capacity to engage in predation. We generated over 6000 mutants and screened each in a standard assay using *B. subtilis* NCIB 3610 as the prey source. Individual mutants were selected based on a display of either increased or decreased predatory capacity. Those mutations affecting predation efficiency were cloned and sequenced. The identification of several genes has enabled us to generate models explaining some aspects of the complex process of microbial predation.

68 - A Fire-Cracked Puzzle; determining the integrity of an archaeological site by refitting fire-cracked rock

Presenter: Luke Stroth

Major/Minors: Anthropology/American Indian and Native Studies, Spanish, GIS

Mentor: James Enloe (Anthropology)

- **Abstract:** Woodpecker Cave was partially excavated in 1956. The record keeping of the mid-twentieth century was poor, and the unscreened back-dirt was dumped on top of intact geological levels, inverting the stratigraphy of the site. A primary goal of the University of Iowa 2012 and 2013 archaeological field schools was to learn more about the deposition of the cave through modern excavation, recording and analytical procedures. In 2012, much of the back-dirt was removed, revealing a Late Woodland occupation (ca. 400-800 CE). The 2013 excavation expanded the area of apparently intact deposits, revealing a hearth composed of ash, charcoal, and fire-cracked rock, rock discolored and cracked by exposure to heat. The subject of my research project is examining the fire-cracked rocks to see if fragments can be refitted. Their vertical and horizontal distributions should be informative about the integrity of the excavation, indicating whether we can discern an occupational surface. The rocks were analyzed with X-ray fluorescence to determine chemical composition as a first step in identifying potential refits, grouping like-mineralogical sets, followed by physical inspection of the fragments for refits. The three-dimensional spatial coordinates of refits will be used to evaluate the integrity of the geological and cultural depositional units.

69 - Examining the expression levels from the different alleles of Fgf10 during *Xenopus laevis* development: How does an allotetraploid modulate extra genetic information?

Presenter: Kyle Strouse

Majors/Minor: Biochemistry & Microbiology/Chemistry

Mentor: Dan Weeks & Sue Travis (Biochemistry)

- **Abstract:** Sensory tissue in the otic placode undergoes vast remodeling during development to form the complex labyrinth that is the inner ear. During this developmental process, cells within the sensory placode secrete and respond to signals that determine their somatic fate. Fibroblast Growth Factor 10 (Fgf10) is a critical peptide signal involved in inner ear development (Mansour & Wright, 2003). In-situ hybridizations of the developing embryos of the diploid frog, *Xenopus tropicalis*, identify high levels of fgf10 in the otic placode, gills, and tailbud (Lea et al., 2009). Our analysis of the Fgf10 genes in the related tetraploid, *Xenopus laevis*, indicate differences in the potential control regions and proteins encoded by the two Fgf10 alleles. We have started to develop assays to understand whether the expression levels of the two alleles of Fgf10 may impart selective temporal or spatial control of development.

70 - Deficient hippocampal neurogenesis in *cacna1c*-deficient mice is corrected by the neuroprotective aminopropyl carbazole P7C3-A20

Presenter: Emily Stuebing

Major/Minors: Neurobiology/Spanish & Pre-Medicine

Mentor: Andrew A. Pieper (Psychiatry)

- **Abstract:** CACNA1C encodes the Cav1.2 Ca²⁺ pore forming subunit of L-type Ca²⁺ channels (LTCCs), which mediate activity-dependent neuronal communication. Genetic variants in the CACNA1C gene have been identified in patients suffering from bipolar disorder, schizophrenia, major depression, and autism spectrum disorder. We have generated forebrain-specific *cacna1c*-deficient mice (fbKO) to investigate the role of Cav1.2 in the brain. fbKO mice exhibit behavioral inflexibility, and we have also reported that these mice display elevated anxiety-like behaviors. LTCCs have shown to play an important role in adult hippocampal neurogenesis. We thus investigated whether neurogenesis is aberrant in fbKO mice. Here, we show that adult neurogenesis is reduced in fbKO mice due to impaired survival of newborn neural precursor cells in the dentate gyrus. We also show that specific knockout of Cav1.2 in the dentate gyrus of fbKO elicits this reduction in hippocampal neurogenesis. To determine whether the neurogenesis deficit in fbKO mice could be circumvented, we administered the neuroprotective compound P7C3-A20 to mice and observed significant neuroprotection of newborn neurons in the hippocampus. Using the fbKO mice in combination with P7C3-A20 thus provides an important tool to examine the role that hippocampal neurogenesis plays in anxiety-related and social interaction behaviors associated with neuropsychiatric disease.

71 - Pigeons Exhibit Contextual Cueing to Both Simple and Complex Backgrounds

Presenter: Yuejia (Mandy) Teng

Major: Psychology

Mentor: Edward Wasserman

- **Abstract:** Repeated pairings of a particular visual context with a specific location of a target stimulus facilitate target search in humans. We developed a novel Cueing-Miscueing paradigm to establish an effective animal model of this contextual cueing effect. Pigeons had to peck a target which could appear in one of four possible locations on four possible color or scene backgrounds. On 80% of the trials, each of the contexts was consistently paired with one of the target locations; on the other 20% of the trials, each of the contexts was randomly paired with the remaining three target locations. When the target was presented 2 s after onset of the background, pigeons exhibited robust contextual cueing, with reaction times to the target being shorter on correctly cued trials than on incorrectly cued trials. During the 2-s delay, pigeons predominately pecked location of the correctly-cued target, suggesting that attention directed toward the upcoming target contributes to the contextual cueing effect. Contextual cueing was more robust with scene backgrounds than with color backgrounds, and more pecks were correctly directed to the location of the correctly-cued target on scene backgrounds than on color backgrounds. Our project thus establishes an effective animal model of contextual cueing.

72 - Evaluation of Age-Dependent Collagen Gel Compaction Ability of Dermal Fibroblasts

Presenter: Jocelyn Todd

Major/Minor: Biomedical Engineering/German

Mentors: Edward Sander & Aribet de Jesus (Biomedical Engineering)

- **Abstract:** As skin ages, the tissue becomes fragile and easily damaged, primarily due to changes in the structure, composition, and mechanics of the skin cells, or dermal fibroblasts. In this in vitro study, gels made of collagen are seeded with cells of this type from patients of different ages. The tension generated by the cells is then monitored by observing and quantifying the change in gel size after its release from the mold. Though this study is currently in progress, we hypothesize that we will see a decrease in tension production with increasing age. Future work includes injecting the gels with dermal filler and studying how the change in environment affects the function of the dermal fibroblasts. Ultimately the information from this study may be used to develop better therapies for restoring or preserving skin health.

73 - Phosphorylation of Gdown1 Regulates Pol II Termination by TTF2

Presenter: Michael Turek

Major: Biochemistry & Psychology

Mentor: David Price (Biochemistry)

- **Abstract:** The majority of human genes have RNA Polymerase II (Pol II) bound in the promoter region, but in a paused state poised to release into productive elongation when the protein P-TEFb phosphorylates it. The protein Gdown1 has been implicated in the stabilization of poised Pol II, inhibiting termination by TTF2 and elongation stimulation by TFIIF. Here we find that the N-terminal domain of Gdown1 is responsible for blocking TTF2 and that the C-terminal is responsible for blocking TFIIF. The N-terminal domain contains its most conserved peptide, LPDKG, which is also present and highly conserved in TTF2. Upon deletion of this peptide, Gdown1 loses its inhibitory effect on TTF2. Additionally we identified a phosphorylated form of Gdown1. In Vitro results show that phosphor-Gdown1 shows reduced activity in blocking TTF2 and TFIIF as it exhibits reduced affinity to Pol II. Mass spectrometry analysis identified the phosphorylation site at the S270 residue. An S270E mutation

mimicked the properties of Gdown1 with an S270-P and an S270A mutation showed the same properties as the unmodified Gdown1. These results explain our observation that the S270-P form is the predominant form of Gdown1 during mitosis, where Pol II is terminated by TTF2 globally.

74 - Scaling and Positioning of Digital Human Internal Organs

Presenter: Samantha Wagner

Major: Biomedical Engineering

Mentor: Tim Marler (Virtual Soldier Program)

- **Abstract:** As digital human modeling capabilities continue to increase, so does their use for increasing survivability of the modern warfighter. The Virtual Soldier Research uses Santos®, a biomechanically accurate, digital human model to simulate warfare. Digital humans engage in a warfare environment for the analysis and optimization of warfighter survivability. Where a soldier is hit ultimately determines survival; does the fragment hit armor, or a vital organ? Thus, it is crucial that when avatar size changes, the organs maintain correct location and scale appropriately. This poses a critical gap within digital human modeling, as no models exhibit the capability to anatomically scale the organs. This work presents a model to overcome this gap. An extensive review of literature was performed to discover factors that determine the dimensional parameters of the organs. Initial results produced models to scale the heart and lungs. After statistical refinement, scaling models were then created using height, weight, and gender of the individual, and implemented into the Santos® software. This work presents a solution allowing the user to change avatar parameters, while maintaining accurate organ size and position. In turn, this provides a novel advancement for digital human modeling, improving capability for survivability analysis of today's warfighter.

75 - Germany, Denmark, Great Britain, the United States and the Future of Sustainable, Cost Effective Healthcare Systems

Presenter: McKenzie Wallace

Majors: Nursing & International Studies

Mentor: Thomas Vaughn (Health Management and Policy)

- **Abstract:** Everyday countries across the world face the rising costs of health care. Many have spent the last decade seeking ways to lower costs while still maintaining a high standard of care. Europe is at the front of this movement and has, in many ways, improved standards of care while finding sustainable models to lower the costs of care. As the United States joins this movement of health care reforms, there are many lessons we can learn from Europe, particularly England, Denmark, and Germany. The main questions this project addresses are 1) How do European health care systems administer care? 2) How do costs stay down? 3) What reforms have European countries implemented to control costs and access to health care? Based on a systematic literature review I have identified a number of practices I believe the United States could adopt to improve its health care systems including changes to the pharmaceutical industry and an increased focus on preventative care.

76 - Mother Earth and Mother Activist: How Women of the Twentieth Century Helped Save the Environment and Spread the Feminist Cause.

Presenter: Kebbi Wedeking

Major: History

Mentors: Landon Storrs & Jeffery Cox (History)

- **Abstract:** My research takes a historical perspective to show the ways in which women who fought for environmental protection in both the first wave of feminism in the Progressive Era (early 1900s) and the second wave of feminism (1960s-1970s), contributed to the cause of the feminist movements and helped to expand these movements.

77 - The brain renin-angiotensin system suppresses digestive efficiency

Presenter: Benjamin Weidemann

Majors: Chemistry & Biology

Mentor: Justin Grobe (Pharmacology)

- **Abstract:** The renin-angiotensin system (RAS) contributes to metabolic control through local actions within the brain and adipose. All components of the RAS are expressed in the gastro-intestinal (GI) tract, leading to the hypothesis that the RAS controls digestive efficiency. Transgenic mice with brain-RAS hyperactivity (sRA model) were generated through neuron-specific expression of human renin, and expression of human angiotensinogen via its own promoter. sRA exhibit reduced body mass and elevated resting metabolic rate through elevated sympathetic nervous activity and a chronic suppression of the circulating RAS. Caloric densities of food/feces were assessed by bomb calorimetry. sRA had increased caloric intake (15.4 ± 0.7 kcal/day, $n=8$) vs littermate control mice (13.0 ± 0.7 , $n=7$, $P < 0.01$) as well as an increase in caloric loss to feces (6.3 ± 0.8 vs 2.9 ± 0.4 kcal/day, $P < 0.01$). Thus, sRA had decreased digestive efficiency (59 ± 5 vs 78 ± 2 %, $P < 0.01$) versus littermates on chow diet, yet total daily caloric absorption was normal ($P = 0.36$). Infusion of the angiotensin (Ang) II type 2 receptor agonist CGP-42112a had no effect on efficiency or absorption (sRA 63 ± 6 vs control 80 ± 1 %; 9.3 ± 0.8 vs 9.8 ± 1.0 kcal/day). We conclude that the brain and circulating RAS help control digestive efficiency, and hypothesize a role for GI tract Ang II type 1 receptors.

78 - Keeper of the Kingdom: Role of Museums in Safeguarding Natural History Research Collection

Presenter: Alyson Wilkins

Majors/Minor: Anthropology & Spanish/Museum Studies

Mentor: Tiffany Adrian (Earth and Environmental Science)

- **Abstract:** The unique role of natural history museums is the stewardship of type specimens, material on which new species and scientific discoveries are made. Working in a modern museum collection such as the University of Iowa Paleontology Repository, involves painstaking documentation of specimens mentioned in scientific papers to create the authority record on the history of each specimen. It is an interesting experience working with specimens that have been in collections for over 150 years and have been on the planet for more than 400 million years.

79 - Forty Year Dash: The Early Era of Cold War Sports Relations

Presenter: Tommy Wisniewski

Majors: Political Science, History, & International Relations

Mentor: Jeffery Cox (History)

- **Abstract:** The Cold War included a volatile period of relations between the United States and the USSR which boiled over in to the realm of sport. The two nations competed in athletic events throughout a period of 40 years of the Cold War, from 1952 to 1991. This thesis analyzes the sport relations of the US and USSR through events between the two superpowers, with primary focus on the Olympics and annual goodwill track meets, and how it affected politics and how politics affected sport during the early portion of Cold War (1952-1966).

80 - GIS Analyses of Ancient Irrigation Tanks in Tamil Nadu, India

Presenter: Joseph Wyckoff

Major: Geography

Mentors: Eric Tate & Marc Linderman (Geography)

- **Abstract:** My research focuses on ancient man-made irrigation tanks in the southern Indian state of Tamil Nadu. These tanks are constructed using earthen bunds that retain rainwater runoff during the monsoon season for use during the dry season. The tanks are connected in cascading systems, with overflow from one tank draining into the next tank in cascade. There are about 40,000 such tanks in Tamil Nadu. With the increasing ease and decreasing price of installing groundwater wells, many farmers are choosing wells over maintaining these tanks. This is exacerbating groundwater depletion due to over-pumping and by removing a major source of groundwater infiltration: the tanks themselves. I have been analyzing data collected in the field by my colleague Mike Steiff, an engineering graduate student at the University of Waterloo, Ontario. This includes GPS transects of the tanks which can be used to calculate tank volume. Mike is also delineating with GPS areas of juliflora, which is an invasive plant species which causes water loss in the tanks due to its deep root systems. These areas can be used to determine the distribution of juliflora across our study area using satellite imagery analysis.

81 - Computational Biology-Tangles Problems

Presenter: Fengfeng Xia

Majors: Mathematics & Statistics

Mentor: Isabel Darcy (Mathematics)

- **Abstract:** Our goal is writing a program of computational method for finding the topological conformation of DNA bound within a protein complex. Our research, for now, is dealing with tangles by using program C. In our program, we only consider the two-string condition so far. We request program users inputting the number of crossings that two-string tangles have, and our program will generate and print out each possible condition in the form of gauss codes, which is an expression of a tangle.

82 - Reductive stress: A cause of human laminopathies?

Presenter: Grant Young

Major/Minors: Biochemistry/ Chemistry & Pre-Medicine

Mentor: Lori Wallrath (Biochemistry)

- **Abstract:** Laminopathies are a collection of diseases associated with mutations in the LMNA gene, including muscular dystrophy, dilated cardiomyopathy, and early onset aging. Lamins are proteins encoded by LMNA that form a meshwork on the inner side of the nuclear membrane. Expression of mutant lamins in muscle cause elevated levels of reduced glutathione (GSH) and NADPH – a condition known as ‘reductive stress’. These findings provide new avenues for therapy.

83 - Unveiling Misconceptions about the Role of Women in Jordanian Society: Democracy, Sharia Law, and Islamic Opposition

Presenter: Onalee Yousey

Majors/Minor: Political Science & International Studies/ Arabic

Mentors: Vicki Hesli Claypool (Political Science) & Ahmed Souaiaia (Religious Studies)

- **Abstract:** The Hashemite Kingdom of Jordan, situated in the heart of the Middle East, has experienced relatively moderate protesting and subsequent reform to its political system as a result of the Arab Spring. Analysis of the Arab Spring, although pervasive, has not adequately considered the public’s opinion on women’s issues and the role attitudes toward women continue to play in shaping the political landscape in the region. This study analyzes Jordanian public opinion in 2012 and addresses misconceptions about the role of women in politics, the workforce, and society. In addition, attitudes toward the roles that women should play in society and politics are shown to be associated with support for Islamic opposition parties, desires for democracy, and opinions on Sharia Law. Contrary to expectations presented by Western media, we learn that support for increased integration of women into Jordanian society comes from unlikely sources; Islamist parties and positive attitudes toward strict Sharia Law have a significant relationship with progressive attitudes toward women.

84 - The Influence of Acoustic Similarity in Monkeys’ Auditory Short-term Memory

Presenter: Iva Zdilar

Majors: Psychology & Neurobiology

Mentors: James Bigelow & Amy Poremba (Psychology)

- **Abstract:** Discriminating and remembering complex sounds such as vocalizations is an important aspect of nonhuman primate communication. However, little is known about how information in complex acoustic signals is used to differentiate and remember important sounds. In two experiments, we investigated the role of acoustic similarity in monkeys’ performance on an auditory short-term memory (STM) task by estimating the spectral, temporal, and harmonic similarity among memoranda. Experimental trials consisted of an initial sound stimulus, a 5-s interval, and finally a second stimulus. Subjects were trained to press a button if the stimuli were the same (match), and withhold from pressing if different (nonmatch). Experiment 1 involved sounds differing in spectral (high vs. low frequency), temporal (static versus pulsed), and harmonic dimensions (tonal versus noisy). Experiment 2 investigated whether this pattern of results would be observed in a STM task including naturalistic sound memoranda. Both experiments showed spectral and harmonic information to be more useful than temporal for discriminating "nonmatch" pairs, and incorrect “match” judgments declined as a function of acoustic similarity. Taken together, the results suggest that monkeys rely chiefly upon spectral and harmonic information in discriminating and remembering complex sounds.

85 - Bladder and Rectal Dose Estimations on Digitized Radiographs for Adjuvant Vaginal Brachytherapy after Hysterectomy

Presenter: Winson Zhang

Major/Minor: Biomedical Engineering/Japanese

Mentor: Yusung Kim (Radiation Oncology)

- **Abstract:** To evaluate the feasibility of accessing ICRU (International Commission on Radiation Units) bladder and rectal point doses using orthogonal radiographs without treatment planning in single-channel vaginal cylinder (VC) adjuvant high-dose-rate (HDR) vaginal cuff brachytherapy (BT) after hysterectomy.

86 - Acid-Sensing Ion Channels (ASICs) are required for Normal Exercise Capacity

Presenter: Mara Zuckerman

Major: Spanish

Mentor: Christopher Benson (Internal Medicine)

- **Abstract:** We have shown that ASICs are highly expressed in skeletal muscle and cardiac afferents, where they are believed to sense metabolic changes associated with exercise. Activation of these afferents during exercise leads to reflex increases in heart rate, blood pressure, and cardiac output, which increases oxygen delivery to the exercising muscles (exercise pressor reflex). In this regard, we hypothesized that ASICs contribute to exercise capacity. To test this we measured maximal exercise workload in wildtype and ASIC null mice (age 10-12 weeks) using a progressive treadmill exercise protocol. We found that mice with targeted deletion of ASIC1a, ASIC2, or ASIC3 each had diminished exercise capacity compared to wildtype. Interestingly, mice that lacked ASIC3, which is only expressed in sensory neurons, had the lowest exercise capacity of any genotype. For unclear reasons, these exercise capacity differences were most pronounced in female compared to male mice. Our data demonstrate that ASICs play a role in maximal exercise capacity, and suggest they are required for normal exercise-mediated reflexes.