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*Celebration
of Research,
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2010 **BOOK OF**
Abstracts



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**Celebration of Research,
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April 16, 2010

Student Abstract Booklet
*A Compilation of Abstracts from Students' Oral and Poster
Presentations*

Office of Undergraduate Research and STEMM Activities
Wright State University
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Schedule of Events

Conference Check-In and Registration: Student Union, E156, E157, E163	7: 30 am - 11:30 am
Oral Presentation, Session I: Student Union, E156, E157, E163	9 am – 11:20 am
Poster Presentations and Lunch: Apollo Room, Student Union	11:40 am – 1:30 pm
Oral Presentations, Session II: Student Union, E156 A, B, C	1:45 – 3:45pm

Art and Art History

Collodion: From Past to Present

Student Presenter: Heather Colley

Faculty Mentor: Tracy Longley-Cook

Department: Art and Art History

My talk will cover my research with the historic photographic process, wet plate collodion. Developed by Frederick Scott Archer around 1850, collodion is one of the earliest forms of photography. The key factors in creating a wet plate collodion image involves: bromide, iodide or chloride salts dissolved into collodion, which is a solution of pyroxylin in alcohol and ether. This mixture is then poured onto a clean glass plate, and allowed to sit for a few seconds. The plate is then placed into a solution of silver nitrate and water, which converts the iodide, bromide or chloride salts to silver iodide, bromide or chloride, respectively. Once this reaction is complete, the plate is removed from the silver nitrate solution, and exposed in a large format camera while still wet. It is then developed with a solution of iron sulfate, acetic acid and alcohol in water. The end result creates unique positive image onto a sheet of glass called an ambrotype. Collodion was soon replaced at the end of the 19th century with dry plates. Dry plates are glass plates with a photographic emulsion of silver halides suspended in gelatin. The gelatin in the dry plates greatly increased the speed of the plates, allowing shorter exposure times than the collodion. In recent years, many contemporary photographic artists have begun using collodion. This revival of collodion is in large part influenced by Mark and France Scully Osterman, current day masters and teachers of the collodion process. The collodion process has now reached many artists of our time such as Sally Mann, who has made a name for herself by using this historic process. Imperfections such as, fogging, spotting, and peeling are common with ambrotypes. Aesthetically, these imperfections appeal to me

and are some of the many reasons collodion interests me.

Art as a Venue for Political Commentary and Social Consciousness

Student Presenter: Gabriela Pickett

Faculty Mentor: Penny Park

Department: Art and Art History

Art has been used in Latin America as a vehicle of social change for over two-hundred years. North America concentrates the teaching of art mostly on observation and the mastery of techniques. This study brings to light the differences between the Latin American focus on subject matter and the American focus on mastery of technique. The subject is relevant to our times because art is an international language. Mexico utilized images to present its history to an illiterate population at the end of the Mexican Revolution. Art can cross borders and break the language barriers that hinder communication. Messages of social justice and the promotion of peaceful conflict resolution nurture an appreciation on a global scale for the unity of the human experience. Social-political art presents the opportunity for a cultural exchange that fosters finding commonalities. A dialogue of art can promote respect for diversity and trigger empathy for others that can lead to action

Athletic Training

Scapular Dyskinesia and Shoulder Instability in the overhead Collegiate Athlete

Student Presenter: Aimee LaRiccia

Faculty Mentor: Tony Ortiz

Department: Athletic Training

Scapular dyskinesia the term for incorrect biomechanics of the scapula. Incorrect scapular

mechanics is typically due to muscle imbalances or shoulder instability. Shoulder instability occurs when there is laxity present within the glenohumeral joint. Both scapular dyskinesis and shoulder instability contribute to shoulder injuries. Shoulder injuries in overhead college athletes are a major concern for Athletic Trainers. Preventive care for scapular dyskinesis and shoulder instability can help prevent shoulder injuries thus increasing the success of overhead collegiate athletes.

Biochemistry and Molecular Biology

Interactions of RXRa with nutrients

Student Presenter: Camila de Jesus Piva

Faculty Mentor: Dr. Heather A. Hostetler

Department: Biochemistry and Molecular Biology

Under healthy conditions, there has to exist a balance between lipid and sugar uptake and metabolism. Several nuclear receptors, proteins that recognize specific molecules and regulate expression of genes involved in many of the body's processes, are thought to be responsible for maintaining this balance. In liver, PPARa has the role to regulate metabolic pathways by detecting lipids. Knowing that PPARa also binds glucose, in the presence of high glucose, PPARa's ability to bind with lipids is altered such that a competition exists between lipids and sugars. The PPARa works by partnering with other nuclear receptors (Retinoid X Receptor alpha, RXRa or Liver X Receptor alpha, LXRa). Since glucose has already been found to bind with LXRa, we want to see if RXRa would also bind glucose or other sugars. In order to accomplish this goal we needed to purify RXRa protein. This was done using a bacterial expression plasmid with a histidine and GST tag. This plasmid was transformed into the Rosetta BL21 strain of E. coli. Several growth and induction conditions were tested. Protein

was purified with metal affinity chromatography using the histidine tag. Protein purity was examined by SDS-PAGE with Coomassie Blue Stain and Western Blot. This purified protein was then used to examine RXRa's ability to bind with sugar. These results could be important since nuclear receptors regulate a lot of genes. The molecules that bind with them (leading to nuclear receptor activation or repression) may strongly affect our health and inappropriate levels may lead to disease

Regulation of the tumor suppressor PTEN by DNp63a

Student Presenter: Mary Leonard

Faculty Mentor: Dr. Madhavi Kadakia

Department: Biochemistry and Molecular Biology

The p53 homolog p63 is critical for the development of all epithelial tissues. The predominant isoform, DNp63a, helps maintain the proliferative potential of basal epithelial cells and is also upregulated in a subset of cancers implicating it as a possible oncogene. Although DNp63a can reduce apoptosis via Akt activation, the exact mechanism by which this occurs is unknown. Given that the PI3K/Akt pathway is antagonized by the tumor suppressor PTEN, we investigated whether DNp63a is able to regulate PTEN levels in order to modulate the activity of Akt. Using overexpression studies we found that DNp63a reduced PTEN levels leading to the activation of Akt, while silencing DNp63a led to increased PTEN and a reduction in phosphorylated Akt. Loss of DNp63a further enhanced PTEN levels when coupled with the PI3K inhibitor LY294002. Chromatin immunoprecipitation and luciferase assays confirmed PTEN as a direct transcriptional target of DNp63a, with response elements distinct from those of p53. Consistent with its role as a tumor suppressor,

loss of PTEN led to increased cell proliferation while loss of DNp63a reduced the proliferative capability of two skin cell lines. Interestingly, concomitant loss of DNp63a and PTEN returned cell growth levels to that of control suggesting that a regulatory loop exists between PTEN/Akt/ DNp63a in order to maintain appropriate levels of cell growth.

Co-Author(s)/Collaborator(s):Ramakrishna Kommagani

YPEL3, A Growth Suppressive Gene That Induces Cellular Senescence

Student Presenter: Kelly Miller

Faculty Mentor: Dr. Steven Berberich

Department: Biochemistry and Molecular Biology

Cellular senescence, the limited ability of cultured normal cells to divide, can result from cellular damage triggered through oncogene activation (premature senescence) or the loss of telomeres following successive rounds of DNA replication (replicative senescence). Both processes require a functional p53 signaling pathway. The tumor suppressor protein, p53, acts as a transcription factor that's activated in response to DNA damage and regulates genes involved in various processes including senescence. Relevant downstream p53 targets associated with senescence induction have been difficult to identify. Discovery of senescence activators is important because induction of tumor cell senescence may represent a therapeutic approach for the treatment of cancer. In microarray studies where the tumor suppressor p53 was reactivated in MCF7 cells, we discovered that YPEL3 (Yippee-like-3), a member of a recently discovered family of putative zinc finger motif coding genes consisting of YPEL1-5, is a p53-regulated gene. Upon validation of this microarray finding, we investigated the biological role of YPEL3 induction in human

cells. The physiological induction of YPEL3 results in a decrease in cell viability associated with an increase in cellular senescence. Through the use of RNAi and H-ras induction of senescence, we demonstrate that YPEL3 activates cellular senescence downstream of p53. Moreover, using various breast carcinoma cell lines we have uncovered that YPEL3 expression is decreased in response to estrogen in ER+ breast cancer cells and removal of estrogen leads to an increase in YPEL3 expression and senescence induction in these cells. Together these results indicate that YPEL3 may serve as a potential senescence associated target useful to anti-cancer drug design. We believe these findings point to YPEL3 being a potential tumor suppressor, which upon induction triggers a permanent growth arrest in human tumor and normal cells. Further experiments are underway to determine the precise mechanism through which YPEL3 induces cellular senescence.

Co-Author(s)/Collaborator(s):Rebecca Tuttle

p73 is essential for Vitamin D mediated osteoblastic differentiation

Student Presenter: Andrew Whitlatch

Faculty Mentor: Dr. Madhavi Kadakia

Department: Biochemistry and Molecular Biology

The secosteroid hormone, Vitamin D₃, contributes to bone formation, keratinocyte differentiation, and exerts anti-proliferative actions in human cancer through its cognate receptor, the Vitamin D Receptor (VDR). Additionally, treatment of osteosarcoma cells with VD₃ induces differentiation by up-regulating genes involved in cell cycle arrest and osteoblastic differentiation. Although considerable work has been carried out in understanding the mechanisms underlying VD₃ mediated differentiation of human osteosarcoma cells, upstream regulation of the

VD3 signaling pathway is still unclear. In this study, we demonstrate that p73, specifically the TAp73alpha isoform, acts as an upstream regulator of VD3 mediated osteoblastic differentiation. We have observed that silencing p73 in osteosarcoma cells leads to a reduction in expression of osteoblastic differentiation markers as well as alkaline phosphatase activity, another marker for differentiation. Additionally, p73 silencing lead to a reduction in VD3 mediated induction of the osteoblastic differentiation markers, OPN and OCN, and alkaline phosphatase. Finally, we have observed that DNA damage in combination with VD3 leads to enhanced osteoblastic differentiation, which was also significantly reduced upon p73 silencing. Taken together, our data suggests a novel role for p73 in vitamin D mediated differentiation of human osteosarcoma cells.

Co-Author(s)/Collaborator(s):Ramakrishna Kommagani, Mary K. Leonard

YPEL3: a transcriptional target of the p53 tumor suppressor gene downregulated in ovarian tumors

Student Presenter: Kevin Kelley

Faculty Mentor: Dr. Steven Berberich

Department: Biochemistry and Molecular Biology

In response to a variety of cellular stresses, the p53 tumor suppressor protein plays a critical role in the regulation of cell proliferation, programmed cell death, and DNA repair. This is essential to facilitate the maintenance of cellular genomic integrity and thus prevent normal cells from evolving into cancerous ones. In cells exposed to DNA-damaging carcinogens, p53 accomplishes such a feat by orchestrating the transcriptional regulation of a myriad of effector genes that influence cell division and genetic homeostasis by forcing the cell to halt division and initiate repair of DNA damage,

respectively. In the event that a cellular stress is too severe for compensatory mechanisms, p53 can activate other target genes that may either trigger the cell to undergo a permanent cell cycle arrest, termed senescence, or eliminate itself by committing "cellular suicide," also referred to as apoptosis. In this present study our laboratory set out to examine whether the human Yippee-like 3 gene (YPEL3) was a novel p53 transcriptional gene target. Using DNA damage, chromatin immunoprecipitation and luciferase reporter assays we demonstrate that YPEL3 is indeed regulated directly by p53. Moreover, we have shown that YPEL3 can inhibit the proliferation of tumor cells by inducing them to senesce. Consistent with a role as a tumor suppressor, levels of YPEL3 were significantly reduced in ovarian tumors compared to normal ovarian tissue. Finally treatment of ovarian cells with 5-aza-deoxycytidine, a DNA methyltransferase inhibitor leads to elevated YPEL3 expression. These results implicate YPEL3 as a potential tumor marker and therapeutic target.

Co-Author(s)/Collaborator(s):Amy Kelley, Rebecca Tuttle

Biological Sciences

Son is Essential for Nuclear Speckle Organization and Cell Cycle Progression

Student Presenter: Alok Sharma

Faculty Mentor: Dr. Paula Bubulya

Department: Biological Sciences

Nuclear speckles provide important spatial organization and dynamic regulation for pre-mRNA processing factors in mammalian cells. While the nuclear speckle proteome is complex, little is known at the molecular level about how these factors are organized into nuclear speckles or how alterations in the organization of these factors impacts gene expression. We have discovered a new function for a large (2564 amino acid) nuclear speckle protein

called Son in maintaining the organization of pre-mRNA processing factors in nuclear speckles. Depletion of Son by RNAi causes snRNP and serine-arginine rich (SR protein) splicing factors to undergo dramatic disorganization into doughnut-shaped nuclear speckles. Rescue of the disorganized nuclear speckle phenotype requires a region of Son with multiple tandem repeat motifs that are unique to Son. This demonstrates that the tandem repeats of Son are necessary for appropriate localization of pre-mRNA processing factors, and it suggests a potential role for Son as a nuclear speckle scaffold. Son depletion does not alter protein levels of other splicing factors, and it does not reduce global transcription or constitutive splicing. However, Son depletion can affect alternative splice site selection. Surprisingly, in addition to its nuclear functions, Son depletion also results in decreased cell proliferation due to growth arrest in mitosis. Son is critical for promoting the transition from metaphase to anaphase. Son is therefore essential for nuclear organization and function, as well as for normal cell cycle progression.

Analysis of Son Localization throughout mitosis and its involvement in mitotic defects

Student Presenter: Keshia Torres-Munoz

Faculty Mentor: Dr. Paula Bubulya

Department: Biological Sciences

During the cell cycle, DNA is replicated and then precisely divided during cell division (mitosis) in order to generate two daughter cells. During metaphase of mitosis, chromosome segregation relies on the assembly of a mitotic spindle comprised of microtubules that attach to and segregate sister chromatids to daughter cells. Son is a large nuclear speckle protein that was found in the proteomic analysis of human mitotic spindles. Recent data from the Bubulya

lab shows that Son is essential for nuclear speckle organization as well as for progression through metaphase of mitosis. This suggests that Son may have some functional role in organizing pre-mRNA processing factors, and it may also regulate cell cycle progression. Localization of Son during mitosis is not known. If Son is involved in mitotic spindle function, it may co-localize with microtubules during mitosis. High resolution microscopy was used to analyze localization of Son throughout mitosis and to compare the localization of Son with respect to spindle microtubules. A less well studied mitotic mechanism involves re-establishing nuclear organization, for example the assembly of nuclear speckles, following mitosis. We also compared localization of Son and the pre-mRNA processing factor Splicing Factor 2/ Alternative Splicing Factor (SF2/ASF). Son co-localizes with SF2/ASF in nuclear speckles during interphase. During mitosis, it may also localize to mitotic interchromatin granule clusters (MIGs), which are mitotic equivalent of nuclear speckles. In order to determine if Son localizes in MIGs we compared the localization of SF2 and Son during mitosis. If Son is important for seeding nuclear speckle assembly we hope to find it is localized in MIGs during mitosis and that it is required for MIG assembly. To pinpoint exact roles for Son during mitosis, future work will involve analysis of mitotic spindle organization and MIG assembly in Son-depleted cells.

Elucidating a role for Btf in transcription and pre-mRNA processing

Student Presenter: Sapna Varia

Faculty Mentor: Dr. Paula Bubulya

Department: Biological Sciences

Nuclear speckles are nuclear storage and assembly sites for pre-mRNA processing factors. Btf (Bcl-2-like transcription factor or BCLAF) was identified in a proteomic analysis of

purified nuclear speckles and it localized in a unique pattern that resembles transcription sites.¹ Our hypothesis is that Btf has a role in the coordination of transcription and co-transcriptional processing of pre-mRNAs. Recently reported cap-dependent association of Btf with in-vitro synthesized affinity purified MS2-AdML-M3 mRNPs is consistent with such a role.² Additional evidence for Btf in transcription and/or splicing comes from our observations showing that Btf accumulates on a reporter gene locus in situ. Since Btf is enriched on the transcriptionally activated locus, but not on the inactive locus, we hypothesize that Btf is recruited to this locus during gene activation. To test this hypothesis, we are using this reporter locus to compare the timing of Btf recruitment with chromatin decondensation and the accumulation of chromatin remodeling factors, transcription factors and splicing factors. SR splicing factors are typically targeted to nuclear speckles by RS domains. Although Btf has an arginine-serine-rich (RS) domain, it localizes predominantly around the periphery of nuclear speckles. We have performed deletion analysis to understand the unique Btf localization pattern. We have confirmed that the RS domain of Btf can function as a speckle targeting sequence on its own; however, removal of the Btf RS domain does not significantly change the Btf localization pattern. This suggests that Btf localization may be regulated differently than other speckle proteins. Our deletion analysis indicates that a specific region of Btf prevents its speckle localization, and that removing this region directs Btf to nuclear speckles. Ongoing studies aim to determine if this regulation occurs via post-translational modification of Btf, or by intermolecular interactions with binding partners.

Co-Author(s)/Collaborator(s): Zhihui Deng, Alok Sharma, Athanasios Bubulya

An assessment of herbivore damage and the enemy release hypothesis as an explanation for the success of the woody invasive *Lonicera maackii*

Student Presenter: Deah Lieurance

Faculty Mentor: Dr. Don Cipollini

Department: Biological Sciences

The 'enemy release hypothesis' argues that when an exotic species is introduced to a novel habitat, it experiences a release from regulation by herbivores resulting in increased distribution, abundance, and vigor. This study aims to assess the amount and incidence of herbivory occurring on *L. maackii* in edge and interior habitats. In October of 2008, leaves were taken from shrubs located in interior and edge habitat from 8 natural areas in Ohio. A follow up study was conducted in 2009, which included multiple sampling dates and a separation long and short shoots. Leaves were assessed for the amount and type of damage. For the 2008 season, approximately 70% of leaves had no herbivory and the damage present on the remaining leaves was between 1-5%. Of those experiencing herbivory, 85% were damaged by chewing. Edge habitat sustained more damage than the interior. Damage rates from this study revealed that levels of herbivory experienced by *L. maackii* are likely too low to impact the fitness of these shrubs. These findings indicate 'enemy release' may contribute to the success of *L. maackii*. Future studies will be conducted to further clarify the role of ERH in the invasion biology of *L. maackii* in Ohio.

Abundance and localization of the Cocksackie-adenovirus receptor

Student Presenter: Abimbola Olayinka Kolawole

Faculty Mentor: Dr. Kate Excoffon

Department: Biological Sciences

One of the most significant changes that occur during development is when epithelial cells transition from a non-polarized to polarized state. This requires the development of a tight junction between cells, separating the apical from basolateral surface. The Coxsackievirus and adenovirus receptor (CAR) is an epithelial junctional transmembrane protein that is involved in cell adhesion and growth. CAR is also important for viral binding to cells and hence its abundance and localization is important for adenovirus infection. We have previously shown that a seven exon isoform of CAR (CAREx7) localizes to the basolateral surface in polarized cells and provides an innate barrier to viral infection. However, we have recently discovered that an alternatively spliced, low-abundance, isoform of CAR (CAREx8) localizes to the apical membrane of polarized primary human airway epithelia. We hypothesize that CAREx8 will be expressed in all epithelial cells and localization will be distinct from CAREx7. We investigated the expression of CAR isoforms in nine cell lines. Through quantitative polymerase chain reaction, confocal microscopy, and Western blot, we found that CAREx8 and CAREx7 are not expressed in Chinese hamster ovary (CHO-K1) cell line but are expressed in several distinct cell types, including human lung adenocarcinoma epithelia (A549), human colonic carcinoma (CaCo2), human submucosal gland (Calu-3), SV40 transformed African Green monkey kidney (COS-7), human embryonic kidney (HEK 293, 293T), Madin Darby canine kidney (MDCK) and normal lung (NuLi-1) cell lines. CAREx7 expression was approximately 10 times more than CAREx8 within all cell types expressing CAR. Whereas both CAR isoforms localize similarly in non-polarized cells (A549, COS-7, 293 and 293T), some CAREx8 was localized to apical surface in polarized cells (CaCo2, Calu-3, MDCK, NuLi-1). Elucidation of the mechanism behind CAREx8 localization may have clinically relevant implications such as the prevention of pulmonary viral infections and

augmenting adenoviral gene therapy approaches.

Co-Author(s)/Collaborator(s): Priyanka Sharma, Kathleen Frondorf

Mechanisms of isoform specific localization and regulation of the Coxsackie virus and adenovirus receptor (CAR)

Student Presenter: Kurt Throckmorton

Faculty Mentor: Dr. Kate Excoffon

Department: Biological Sciences

Adenoviruses are a common cause of respiratory illness including pneumonia, and are also prime candidate vectors for gene therapy. Adenoviruses share a receptor (CAR) with Coxsackie viruses, but the mechanism of their infection is not fully understood. This receptor exists in multiple isoforms in human airway epithelia. A seven-exon isoform (CAR-Ex7) localizes primarily to the basolateral membrane, while a newly discovered eight-exon form (CAR-Ex8) localizes to the apical and sub-apical compartments where it is more likely to mediate adenoviral infection. These two forms differ only in their C-terminus – 26 amino acids unique to CAR-Ex7 are replaced by 13 in CAR-Ex8 – but they have been observed to interact differentially with another cellular protein, MAGI-1b. Whereas CAR-Ex7 co-localizes with MAGI at cell-cell junctions, CAR-Ex8 is degraded upon co-expression with MAGI. We hypothesized that two tyrosines unique to CAR-Ex8 might be instrumental in this process and investigated this through site-directed mutagenesis, immunofluorescence microscopy, co-immunoprecipitation, Western blot, and adenoviral infection. We have discovered that, when either of these tyrosines is mutated individually, the differential interaction between CAR and MAGI persists, but when both are mutated together, the degradative interaction is ablated. We therefore conclude that the interaction between CAR-Ex8 and

MAGI requires at least one of these tyrosines. Moreover, mutation of both tyrosines alters the activity of CAR-Ex8 as an adenovirus receptor. Further elucidation of the mechanism behind isoform specific localization of CAR may lead to a greater understanding of viral pathogenesis and new approaches to viral-mediated gene therapy.

Regulation of the expression of aquaporins in hepatocytes from the *Hyla chrysoscelis*

Student Presenter: Kyle Leggett

Faculty Mentor: Dr. David Goldstein

Department: Biological Sciences

My research is focused on the understanding of integral membrane proteins called aquaporins that permit the flow of water through the lipid bilayer of the freeze-tolerant amphibian *Hyla chrysoscelis*. These proteins selectively let water in and out of the cell down any existing osmotic gradient, and some aquaporins also facilitate diffusion of some small uncharged solutes. More specifically my research focuses on hepatocytes from the liver and whether or not these aquaporins are expressed in these cells and what stresses regulate their expression. For example, HC-3 is a specific aquaporin that permits the flow of glycerol in order to prevent freezing. Therefore, as the liver plays a critical role in metabolism and synthesis of glycerol, I hypothesized that HC-3 expression would be increased by stimuli likely to be associated with transitions to cold and freezing conditions. Aquaporin expression may be regulated by a variety of factors, including hormones. Arginine Vasotocin (AVT) is the amphibian Anti Diuretic Hormone, analogous to arginine vasopressin in humans. Because freezing is a form of dehydrational stress, we hypothesized that AVT would be associated with the physiology of freezing. We are using an in vitro system—primary cultures of hepatocytes—to study whether HC-3

expression is enhanced by AVT. To test this hypothesis, we have developed the method for isolating and culturing hepatocytes, and for maintaining these cultures for several weeks. Using this system, we can add AVT or other potential stimulants, such as glycerol or sucrose, and observe the responses of the cells. We are examining protein expression using Western immunoblots and immunofluorescence. Functional consequences of protein expression are assessed using osmotic swelling assays. The objective of this research is to use an animal model system to understand the regulation of aquaporin proteins. At the same time, we will come to better understand the physiology of tissue freezing and the factors that contribute to successful cryopreservation.

Aquaporin Expression in Freeze Tolerance

Student Presenter: Monalisa Moreira Queiroga

Faculty Mentor: Dr. David Goldstein

Department: Biological Sciences

A class of integral membrane proteins known as aquaporins play an essential role in maintaining water balance, by forming selective water pores in the plasma membrane of various cells of animals, plants and microorganisms (Zardoya, 2005; Fu and Lu, 2007; Verkman, 2008). Cope's grey tree frog, *Hyla chrysoscelis*, is unusual among animals because it can survive freezing. Cold acclimated *Hyla chrysoscelis* show increased expression of aquaporins compared with *Hyla chrysoscelis* at warm temperatures. We hypothesized that aquaporins are critical for this animal's cells to survive the freezing process. In this study, aquaporin expression is examined under two conditions: warm frogs (20°C) and cold acclimated frogs (4°C). We will quantify expression of aquaporins by Western blot, and we will use immunofluorescent imaging to examine whether aquaporin expression is localized at the cell membrane, where these

proteins provide their function. The correlation between expression of aquaporins and their functionality in liver of *H. chrysoscelis* that were acclimated to warm and to cold temperatures is also being tested. Osmotic swelling assays are used to quantify total membrane permeability, allowing the correlation of the expression of aquaporins with the presence of functional proteins. Cells will then be frozen at -2.5°C for 24 hours and cell survival measured with trypan blue viability assays. By comparing cells from the warm and cold animals, it will be possible to show if increased aquaporin expression levels is associated with increased survivability of the cells after freezing, showing an important role of aquaporins in the maintenance of cells at low temperatures related to thermal acclimation.

Co-Author(s)/Collaborator(s): Dr. Robert Wysong, James W. Frisbie, III

Secondary messengers responses during overwintering in tree frogs

Student Presenter: Roopsi J. Narayan

Faculty Mentor: Dr. David Goldstein

Department: Biological Sciences

Cope's gray tree frog, *Hyla chrysoscelis*, is tolerant of being frozen. In that process, glycerol serves as a primary cryoprotectant. We have hypothesized that the distribution of water and glycerol is facilitated by the expression of aquaporins, membrane proteins that confer permeability to water and glycerol. Glycerol production during cold acclimation is probably triggered through a signal transduction pathway from the peripheral body regions. Physiological responses to such extracellular signals are mediated through secondary messengers. Changes in the levels of cAMP and IP3 are being analyzed in both warm-acclimated and cold-acclimated hepatocytes of *Hyla chrysoscelis*. Enzyme-linked immunoassay is used for quantifying the levels of cAMP and

radioimmunoassay for IP3. Changes in patterns of cAMP and IP3 can give us insights into regulation of uptake and transportation of glycerol by aquaporins.

Variability in Body Fat Measurements

Student Presenter: Brittany Reinert

Faculty Mentor: Dr. Lynn Hartzler

Department: Biological Sciences

Background: Obesity is taking on epidemic proportions worldwide and comes with many health consequences such as coronary artery disease, type 2 diabetes, hypertension, osteoarthritis, sleep apnea, and respiratory problems. Obesity can decrease life span by 2-4 years (BMI 30-35 kg/m^2) and 8-10 years (BMI 40-45 kg/m^2) mostly because of vascular disease. Obesity also contributes to economic costs through medical expenses approximating \$78.5 million dollars. The causes of obesity are believed to be linked to genetics and/or environmental factors. Purpose: The purpose of this study is to find the most convenient and best inexpensive indicator of measuring body fat for individual body types by comparing common measurements to the gold standard air displacement plethysmography (BodPod). Methods: Skinfold measurements are taken at nine locations: suprailiac, abdominal, tricep, bicep, chest, midaxillary, subscapula, thigh, and calf. Other measurements include upper body bioelectrical impedance, waist and hip circumference, and air displacement plethysmography. BMI and waist to hip ratio will be calculated for comparisons as well. Results: Preliminary data indicates that the female 3-site skinfold equation ($Bd = 1.089733 - 0.0009245(\text{sum of SKF}) + 0.0000025(\text{sum of SKF})^2 - 0.0000979(\text{age})$) including only triceps, suprailiac, and abdominal skinfold sites is an accurate measurement for overweight men and normal weight women. We suggest that current male skinfold equations severely

underestimate body fat in overweight men, making female equations more accurate for this group. Preliminary data also indicate that bioelectrical impedance severely underestimates body fat percentage for women, especially those who are at normal weight or who are underweight.

Effects of XS[®] Energy Drink on Aerobic Exercise Capacity

Student Presenter: Kevin Sheehan

Faculty Mentor: Dr. Lynn Hartzler

Department: Biological Sciences

This project examines effects of taking XS[®] Energy Drink for the purpose of enhancing aerobic exercise capacity and performance. XS[®] Energy Drink contains B vitamins, caffeine, taurine, and an adaptogen blend and is primarily designed and marketed to stimulate alertness; however, it is also marketed to athletes claiming to enhance performance. Our hypothesis is that consuming the XS[®] Energy Drink before exercise increases aerobic capacity and the time to muscle fatigue when compared with a placebo. We also hypothesize that consuming XS[®] Energy Drink before exercise decreases recovery time. Twelve physically fit 18-24 year olds performed two VO₂ max tests according to a modified Ellestad Treadmill Protocol using a randomized double-blind cross over method. We found no significant differences with XS[®] Energy Drink: VO₂ max ($p = 0.99$), time until muscle fatigue ($p = 0.48$), maximum heart rate ($p = 0.66$), VE max ($p = 0.10$), time at which $R > 1$ ($p = 0.50$), or recovery time to 50% VO₂ max ($p = 0.67$). We found the second trial to be significantly longer than the first ($p = 0.01$) likely due to desire to improve exercise time or familiarization with testing procedures. Our results show no physiological effects of XS[®] Energy Drink; however, we have not eliminated a possibility of psychological advantage. Supported by an

undergraduate research fellowship and University Honors Program grant from Wright State University (KMS).

Littoral Sediment Bacterial Production and abundance in Four Temperate Oligotrophic Lakes

Student Presenter: Shawn Devline

Faculty Mentor: Dr. Yvonne Vadeboncoeur

Department: Biological Sciences

Much of what we know regarding bacterial dynamics in lakes has been derived from pelagic based studies. Investigations into benthic bacterial production (BP) and bacterial abundance (BA) in the littoral zone are rare. Littoral sediments in oligotrophic lakes range from sand with little organic matter to highly organic mud comprised of allochthonous carbon from exogenous sources or autochthonous benthic primary production. The ratio of benthic primary production to benthic OM content (BPPr:OM) provides an integrated index of the source and amount of benthic OM. We measured benthic bacterial production and abundance in the littoral zones of four oligotrophic lakes with varying sediment types each season over the course of one year. Seasonal variation in bacterial production was high, illustrating a significant relationship between BP and temperature ($t = 5.274$, $p < .0001$). Among lake differences in source and amount of sediment organic matter drive variation in BP and BA across lakes along a BPPr:OM gradient. Autochthonous organic matter content of littoral sediments could regulate bacterial dynamics and impact ecosystem processes such as nutrient recycling and trophic linkages to organic carbon pools.

Contrasting tritrophic and bitrophic explanations for phenotypic divergence in an adaptive radiation

Student Presenter: Jeremy Heath

Faculty Mentor: Dr. John O. Stireman III

Department: Biological Sciences

Herbivorous insects face numerous ecological challenges when radiating into new niches. Host plant defenses and natural enemies represent two major obstacles that can hinder niche colonization. However, the relative importance of these trophically dissimilar selective forces and their interaction in driving adaptive radiation is still unclear. Here we use field and common garden experiments to tease apart the relative importance of natural enemies and plant defenses in driving an adaptive radiation of the *Ambrosia* gall midge complex (*Asteromyia carbonifera*, Diptera: Cecidomyiidae) on *Solidago altissima* (tall goldenrod). In a common garden of ten tall goldenrod genotypes we assessed how parasitism rates are affected by gall height on the plant, gall developmental rate, plant growth rate, plant vigor, and gall morphotype. We also assessed the density of gall morphotypes on the various goldenrod genotypes. Our results indicate that the crescent morph is initiated significantly lower on the plants. A subsequent controlled experiment revealed that adults of this morphotype actually oviposit on mature tissue rather than delay development, which is unique within the Cecidomyiidae. Gall density varied with goldenrod genotype and the crescent morphotype was the most polyphagous. We assessed the attack rates of parasitoids on the four gall morphs on tall goldenrod in several field populations. The results revealed a relatively consistent correlation between phenotype (i.e., gall morphotype) and parasitoid attack. For instances, the thickest gall morph (i.e., cushion) was attacked most heavily by the parasitoid with the longest ovipositor. These results illustrate that a

multitude of ecological, physiological, and behavioral factors are important in understanding the adaptive radiation in this system; with natural enemies likely playing an important role.

Co-Author(s)/Collaborator(s): Brenda Wells

Biomedical, Industrial and Human Factors Engineering

Developing a Virtual Patient for Communication Training

Student Presenter: April Barnes

Faculty Mentor: Dr. Jennie Gallimore

Department: Biomedical, Industrial and Human Factors Engineering

Virtual patients (VPs) are interactive computer simulations of clinical scenarios used for medical training, education or assessment. This presentation will discuss formative research on the development of a VP for training communication skills. A communication model is being developed based on input from expert clinicians, extensive literature review, and on theories of communication. A prototype VP has been developed that utilizes speech recognition and a script-mapping mechanism to allow the learner to converse with the VP in a natural manner. Emotion detection will be added to analyze voice characteristics (tone, inflection, etc.) in addition to the content of the spoken words. Affective communication of the learner will be identified based on this information and the VP will respond appropriately. The integration of the communication model, speech recognition and emotion detection will result in a higher fidelity VP. The VP will have human-like conversation skills that are more representative of actual physician-patient interactions. Metrics for communication effectiveness will be developed so that performance can be objectively analyzed. It is

expected that the improved fidelity of the VP interaction will significantly improve the training of communication and interpersonal skills for health care providers. This research is the first phase of a long-term goal to develop a completely immersive, longitudinal surgical scenario utilizing different forms of medical simulation including computer-based VPs, surgical simulators with haptic controls, high-fidelity mannequins and virtual environments.

Co-Author(s)/Collaborator(s): Phani Kidambi

A multiple sensor wireless data acquisition system to analyze gait in human beings

Student Presenter: Anoop Ramakrishna

Faculty Mentor: Dr. Blair Rowley

Department: Biomedical, Industrial and Human Factors Engineering

With a demographic increase in the geriatric population, there has been a steady rise in the number of morbidities and mortalities associated with falling. With an increased life expectancy and the active lifestyles in the elderly and emphasis in geriatric research is being laid on techniques to predict and analyze gait patterns, methods to identify diagnostic measures that act as reliable predictors for fall in the elderly. Correlating sensor outputs to body movements, determining gait variability between subjects belonging to different age brackets, studying the differences in muscle characteristics among the elderly and the young, studying the neural activity associated with motor nerves in the elderly and the young and relating it to activities of daily living are some of the topics that researchers have conducted extensive studies on. There are many areas in the geriatric sphere that have still not been explored in depth and one of them being characteristics of a fall. In our study we have developed a system that reads the outputs of 3 gyroscope sensors mounted on a subject and transmits a multiplexed signal

containing all three sensor outputs via Bluetooth to a base station. Designing the system, recording sensor output data using Mat lab, analyzing the data, determining the range of operation of the sensor, developing a user interface are some of the important goals we have met to make improvements to the existing system. Future development includes trials conducted on subjects in a clinical setup to determine behavior of the sensor towards induced falls.

Uses and Challenges of Health Information Technology in Healthcare Delivery Systems: A Multidisciplinary Perspective

Student Presenter: Jennifer Cloud-Buckner

Faculty Mentor: Dr. Jennie Gallimore

Department: Biomedical, Industrial, and Human Factors Engineering

Despite a growing use and development of health information technology (IT), healthcare does not have an ideal system that enhances communication, measurably improves care, prevents errors, and works seamlessly without workflow disruption. Many obstacles to this ideal system exist. Health IT is implemented into a socio-technical system with human users, organizational and system-level processes, and many sources and forms of information that must be in specific places at specific time in order to achieve quality of care. Therefore, analysis of health IT implementation must be multidisciplinary. Healthcare organizations call for research in care coordination, handoffs, patient awareness, and error prevention. This research can be pursued with a comprehensive analysis of clinical and technological processes using tools from Industrial and Systems Engineering (ISE), Human Factors Engineering (HFE), and Human-Computer Interaction (HCI). With examples from prescription management, telemedicine, e-health applications, and general medical practice, this presentation

shows how HFE, ISE, and HCI techniques can be used to analyze and design health IT to improve quality of patient care.

Computational simulation of head impact injury finite element analysis

Student Presenter: Aalap N. Patel

Faculty Mentor: Dr. Tarun Goswami

Department: Biomedical, Industrial, and Human Factors Engineering

Injury to the head constitutes one of the major causes of death. Despite increased use of protective device brain injury disables or kills someone in the USA every two and a half minutes. The annual cost of hospitalization and rehabilitation within USA has been estimated to be some twenty five billion dollars. The type of injury is determined by the location and severity of the mechanical distortion of the skull bone, blood vessel and brain tissue. Biomechanical research attempts to understand the development of injury and thereby help to avoid or alleviate the damage that can occur from various impacts. Finite element modeling offers significant potential for understanding and predicting the mechanical and physical response of a brain to impact loadings. Aim of the study: The aim of this study is to get the results of computational simulation of the impact to the head and predict development of impact zone within the layers of skull-brain system and coup and countercoup contusion (at and opposite side of the impact, respectively) within the brain tissues. Methodology: We have made an analytical 3D model composed of three layers-skull, cerebrospinal fluid and brain tissues in order to investigate the dynamic response of the human head when subject to direct impact events. The physiological consequences of modeling the human brain as being elastic are established. CT scan images of cadaveric head were used to make this model by using

software Mimics® and finite element analysis was performed through software ABAQUS® Results: Negative pressure and positive tensile strain were observed at the site of impact (coup) while vice versa in opposite site of the impact (countercoup) at the moment of impact time. Variation in stress distribution and severity occurred as per change in velocity of the direct and indirect impact.

Co-Author(s)/Collaborator(s): Mbulelo Makola, Manthan Patel

FEA of Proximal Humerus Locking Plate Using Bone and Implant Model

Student Presenter: Alyssa George

Faculty Mentor: Dr. Tarun Goswami

Department: Biomedical, Industrial, and Human Factors Engineering

Finite element analysis (FEA) of orthopaedic implants has become a common tool for evaluating the mechanical performance for various implant designs. While these models have been very useful, the application of forces directly to the implant limits our ability to accurately model the interaction of the implant with the bone. Our goal in this work has been to create modeling of both the bone and the implant simultaneously with forces applied to entire system so that the interaction forces between the two can be more accurate. A recent study in our lab by Schumer et al of proximal humerus locking plates was done on cadaveric humeri to compare the use of smooth pegs versus threaded screws for fixation. Cyclic torsion testing was done at ± 2 Nm for 3000 cycles with results around 1.5 degrees of displacement and at ± 5 Nm for 3000 cycles with results around 5 degrees of displacement. Load to failure testing was also done with results around 1300 N of load at failure. Our current study is now using finite element modeling to recreate these physical tests. Computed tomography (CT) images of

the humeri and implants have been used to create models with Mimics® software (Materialise, Ann Arbor, MI, USA). The FEA of these models is being done in Abaqus FEA software (SIMULIA, Providence, RI, USA) to simulate the physical testing. The modeling results will be compared to the physical results. Eventually, we hope to supplement the physical tests with these modeling tests for cases where physical tests are limited by resources, such as the number of cadaveric bones available.

Application of newer technologies for the prediction and prevention of preterm birth

Student Presenter: Angus Acton

Faculty Mentor: Dr. Tarun Goswami

Department: Biomedical, Industrial, and Human Factors Engineering

With an annual economic burden to society exceeding \$25 billion and a 12.7% prevalence rate in the United States, preterm birth remains one of the leading factors contributing to perinatal mortality and morbidity. While obstetric care has been improving over the last decade, preterm birth rates have continued to rise. Current technologies for the assessment of risk associated with preterm birth include biophysical and biochemical factors, as well as demographic and socioeconomic factors. However, a comprehensive database encompassing all of these factors does not exist. By combining currently measureable factors with measurements from newer technologies, a better model for the assessment of risk as well as prediction of preterm birth can be achieved. Furthermore, it may provide insight regarding the underlying mechanisms associated with preterm birth, while simultaneously alleviating the economic burden and removing disparities in the rate of preterm birth among different populations of women.

Total Ankle Replacements

Student Presenter: Ashkahn Golshani, Omar Abousoud

Faculty Mentor: Dr. Tarun Goswami and Dr. Richard Laughlin

Department: Biomedical, Industrial, and Human Factors Engineering

A retrospective cohort study to compare the outcomes of patients who received different total ankle replacements, and also compare outcomes in patients who received total ankle replacements versus patients who received ankle fusion at Miami Valley Hospital. This can allow us to compare the efficacy of the different ankle models used at Miami Valley Hospital. Ideally, we would like to see what elements of existing ankle models are advantageous and can be implemented into future models, or even enhance our current existing models. We would also like to see what kinds of complications are associated with the different models versus ankle fusion. Our plan is to do a chart review of patients who received total ankle replacements or ankle fusion at Miami Valley Hospital over the past 5 years, send out a standardized survey to each person, perform statistical analysis on the data we collect, and describe the total ankle replacements currently used at Miami Valley Hospital. Statistical analysis will be performed in order to see what outcomes are beneficial, detrimental, and factors that increase patient comfort. This will be done without invading patient privacy and HIPPA guidelines will be respected.

Federal Aviation Administration Advisory Circular 33.70-2 Calibration Test Using DARWIN Part II

Student Presenter: Ashley Whitney-Rawls

Faculty Mentor: Dr. Tarun Goswami

Department: Biomedical, Industrial, and Human Factors Engineering

The Federal Aviation Administration (FAA) Advisory Circular (AC) 33.70-2 provides a calibration test case as a means for the FAA to assess a contractor's capability to perform analytical lifing procedures. The calibration test was conducted using the probabilistic risk analysis program Design Assessment of Reliability With INSpection (DARWIN). An overview of DARWIN is presented. The required maximum stress field condition was determined by Jace Carter using the ABAQUS finite element code in part-one of this presentation. The circular states that the probability of failure (POF) of the bolt hole feature of a rotating titanium ring is governed by the single most life limiting crack location. A sensitivity analysis was conducted using DARWIN to determine this crack location. The maximum fracture toughness and crack area at failure were also determined. The probability of failure was calculated for both with and without component inspection. In both cases the results were found to be within the acceptable ranges as defined in the AC. The loading profile specified in the AC is a simplistic singular zero to maximum load cycle representing a single main mission cycle. In addition, more realistic loading profiles contain a series of sub- and main-cycles, i.e., TURBISTAN is a loading sequence standard for fighter aircraft that was derived from the rotation per minute sequences of fighter engines. The TURBISTAN navigation mission type, which are characterized by long cruises are representative of the loading of a typical passenger planes which must meet FAA standards. The AC calibration test case was analyzed using the TURBISTAN navigation loading profiles and the results are discussed.

Co-Author(s)/Collaborator(s):Jace Carter

Vertebral endplates: A finite element analysis

Student Presenter: Isaac Mabe

Faculty Mentor: Dr. Tarun Goswami

Department: Biomedical, Industrial, and Human Factors Engineering

Endplates of a vertebral body are crucial to the performance of the spinal column. The vertebral endplate acts a boundary for the intervertebral disc so that it does not herniate into the body of the vertebrae. Stresses throughout the disc are increased as a result of the disc extrusion. The endplate allows this extrusion by increasing porosity, which occurs naturally with age. The endplate has multiple layers however is typically not modeled as such. It is comprised of a porous bony plate, a hyaline cartilage layer and the remains of the epiphysis plate also known as the growth plate. In most simulations the endplate is treated as a homogenous layer due to its relative thickness of about a millimeter. Due to the thickness of the endplate and the boundary conditions supporting the endplate finite element methods are used to analyze the endplate for stresses and strains. This report will attempt to analyze the endplate with multiple layers including the cartilaginous and bone parts of the endplate. The cortical bone on the periphery of the vertebral body will support the endplates. To model increasing porosity via fracture the endplate will be adjusted geometrically according to increased porosity and the stress and strain will be compared. Several methods are available to fix the damage caused by the fracture of the endplate and increases herniation. Fusion and disc arthroplasty are two orthopedic options for correction. A comparative study of fixation devices and disc replacements will also be included in this study. The goal of this study will be to further understand the biomechanics of the vertebral body endplates. Also an investigation will be conducted into the orthopedic treatment options available for intervertebral disc arthroplasty or fusion.

**Federal Aviation Administration Advisory
Circular 33.70-2 Calibration Test Using
DARWIN Part I**

Student Presenter: Jace Carter

Faculty Mentor: Dr. Tarun Goswami

Department: Biomedical, Industrial, and
Human Factors Engineering

The Federal Aviation Administration (FAA) Advisory Circular (AC) 33.70-2 provides definitions and acceptable methods for determining the probability of failure (POF) of hole features in high-energy turbine engine rotors. A calibration test case is used as a means for the FAA to assess a contractor's capability to perform analytical lifing procedures. The calibration test case specifies the necessary information needed to determine the POF of a bolt hole feature of a rotating titanium ring. This test case information is discussed in detail as well as steps taken to verify the analytical models used. Two essential pieces of information were noted as missing from the circular, i.e., a stress-strain model, and a tabular data set for the probability of detection curve. The probabilistic risk analysis program Design Assessment of Reliability With INspection (DARWIN) has been approved by the FAA as a suitable tool to conduct risk analysis for certification of new titanium rotor designs in compliance with AC 33.70-2. DARWIN requires the maximum stress conditions in order to determine the POF of the rotating ring. The maximum stress state was determined using ABAQUS. Both elastic and plastic material properties were used. Nominal stress and strain were converted to true stress and strain with strain decomposed into its elastic and plastic strain portions. The ABAQUS stress model was validated against a closed form solution for an elastic annular disk without a hole. A finite element mesh convergence study was also conducted. This ABAQUS stress analysis, in conjunction with the information in the AC calibration test case, was used to determine the POF of the rotating ring

by Ashley Whitney-Rawls. The POF analysis is presented in part-two of the presentation.

Co-Author(s)/Collaborator(s):Ashley Whitney-Rawls

**Stress shielding in uncemented hip implants: a
study using finite element analysis**

Student Presenter: Manthan Patel

Faculty Mentor: Dr. Tarun Goswami

Department: Biomedical, Industrial, and
Human Factors Engineering

The finite element method and modeling has become very important in various simulations and analysis of orthopedic implants. Researchers are using this technique exclusively for stress simulations and fracture predictions. Hip implants show a considerable degree of stress shielding after significant amount of time after implantation. So, the aim of this study is to compare simulated stress analysis results for various hip implants which are commercially available. One of two type of prostheses (i.e. uncemented) was being used for analysis. The results gave idea about the degree of stress shielding in various hip implants which lead to design optimization to avoid stress shielding. The total hip prosthesis must be securely attached within the skeleton for good function. There are two methods to secure the fixation of the total hip prosthesis to the skeleton. These methods are bone cement and cementless techniques. In the bone cement total hip technique, bone cement is used for fixation of the prosthesis to the skeleton. In the cementless technique, the total hip is directly fixed into the bed prepared in the skeleton. If the stem shape design leads to high stresses in fixation areas of the prosthesis, fracture in short term or fatigue failure in long term of the prosthesis quite likely occurs. This phenomena of generation of higher stresses after implantation is referred to as STRESS SHIELDING of hip implants. So, a

computational study was performed using finite element analysis (FEA) of three dimensional solid hip implant models. Four different hip implant models were utilized to compare the von mises stress generated after simultaion. The parameters examined were the magnitude of von mises stress and the area having highest magnitude stress which should be accounted for during total hip implant design as well as in the practice of arthroplasties. A static analysis was performed for all 4 hip designs using CoCr alloy.

Press Fit Hip Implant Interfacial Motion Analysis

Student Presenter: Mbulelo Makola

Faculty Mentor: Dr. Tarun Goswami

Department: Biomedical, Industrial, and Human Factors Engineering

Press fit hip implants present marked advantages and disadvantages as compared to cemented hip implants. Implant fixation plays an important role in the stability, efficacy, and longevity of press fit hip implants. A key factor in implant fixation is the amount of interfacial motion between implant stem and the femur. A finite element analysis (FEA) was performed on several hip implant designs to study interfacial motion between implant and femur. Implants were of distinct cross section and stem design. Each implant was subject to loading simulating a 160lb person taking a step forward. Three materials were used for the analysis; Cr-Co-Mo, Stainless Steel SS316L, and titanium alloy Ti-6Al-4V. Results showed that implant profile and stem design along with material played a role in the amount of interfacial motion.

Three-dimensional modeling and finite element analysis of mandible

Student Presenter: Shirish Ingawale

Faculty Mentor: Dr. Tarun Goswami

Department: Biomedical, Industrial, and Human Factors Engineering

Objective: Analysis of mandibular biomechanics under functional and parafunctional loading to understand the interaction of form and function. **Problem statement:** The degenerative changes in mandible are believed to result from functional and parafunctional overloading. With millions of people suffering from temporomandibular disorders (TMD), it is a problem that needs to be investigated more fully. Comprehensive biomechanical analysis of mandible is necessary for better diagnosis, treatment, and cure of joint disorders. To the best of our knowledge, no study has so far reported comparative mechanical stress development in the mandible under different functional and parafunctional loading conditions. **Methodology:** We developed a patient-specific 3D model of mandible (with cortical bone, cancellous bone, teeth, and cartilage) from CT scan using Mimics® software. Finite element analysis (FEA) was performed to investigate comparative mechanical stress development under four loading conditions: balanced occlusion, unbalanced loading, teeth grinding, and clenching. Simulations were performed using bite forces and muscle forces independently. Currently, we are in the process of testing cadaveric mandibles – the results of which will enable us validate the findings of FEA. **Data to be included:** Mandibular 3D model; visuals of loading and stress maps; tables of material properties, forces, and corresponding stress generation in the condylar cartilage; plot of von Mises stress. **Results:** The simulations, for bite forces as well as muscle forces, resulted in the least maximum von Mises stresses in the condylar cartilage during balanced loading of the mandible. The maximum von Mises stresses of increasing order were observed for unbalanced loading, teeth grinding, and clenching. **Conclusions:**

Higher stress development during parafunctional loading of the mandible may explain why malocclusion, teeth grinding, and clenching might be the contributing factors for mandibular dysfunction. The results of cadaver testing will provide further insight into this analysis.

Statistical Analysis of Hip registries in Australia, Canada, Norway, and Sweden: Projection on the United States

Student Presenter: Susan Schweitzer

Faculty Mentor: Dr. Tarun Goswami

Department: Biomedical, Industrial, and Human Factors Engineering

According to the American Academy of Orthopaedic Surgeons there are approximately 500,000 hip replacements done in a year in the United States. In this study an analysis of hip registries available in Australia, Canada, Norway, and Sweden was done in order to answer the questions of who is and when are people getting hip replacements. Further research was done using census information from each country to find how the number of hip replacements was reflected in the general population. The information gleaned from the census was used to create projections onto the United States population as no official hip registry is currently in existence. In order to do a projection analysis onto the United States population it is important to be sure that the registries are significantly correlated to each other. Statistical analysis of the four hip registries found that age group, and gender were statistically correlated. Furthermore, there was a statistical correlation between the census information between all four countries. A statistical correlation was found between the four other countries and the United States when comparing the census information, which allowed for a projection from the former to the latter. The projection on the United States

allowed a proper estimation of hip replacements for the various demographics through the year 2030.

Magnetic resonance imaging of tumor response and cognitive impairment in breast cancer patients undergoing anthracycline-based systemic chemotherapy

Student Presenter: Abdullah Al Adalah

Faculty Mentor: Dr. Jason G. Parker

Department: Biomedical, Industrial, and Human Factors Engineering

Breast cancer is the most common cancer of women worldwide. The American Cancer Society estimated there were approximately 1.4 million new cases of invasive breast cancer worldwide in 2008. Anthracycline-based systemic chemotherapy is an important tool in the treatment of breast cancer, which is used to downstage the tumor before surgery and/or for palliative treatment in non-operable conditions. One common complaint of chemotherapy is a feeling of cognitive impairment, characterized by difficulty multitasking, difficulty keeping up with busy work environments, and an overall foggy mental feeling. Collectively, these effects are referred to as chemobrain. An active area of research is in the development of methods to predict response to chemotherapy, which could be used to tailor treatment and estimate prognosis with a greater degree of accuracy. Also, early subclinical detections of chemobrain could help to minimize side effects by modifying or changing the chemotherapy regimens. The purpose of the study is to evaluate the use of advanced MRI techniques to predict and monitor tumor response and to evaluate the changes in cognition in response to chemotherapy. Our experimental design will study 15 female adult breast cancer patients recruited from the Medical Oncology

Hematology Associates group in Dayton, Ohio. Eligible subjects will receive thorough verbal and written informed consent-oriented explanations of the study. Each subject will undergo 4 non-invasive advanced magnetic resonance imaging sessions of the breast and brain using MR spectroscopy (MRS) and functional MRI (fMRI), respectively. Imaging sessions 1 and 4 will be accompanied by neuropsychological testing to assess the cognitive functions of the brain. We will recruit up to 15 normal control subjects to perform 2 imaging sessions accompanied by 2 neuropsychological tests 6 months apart. MRS will be evaluated as a predictor of treatment response by correlating baseline metabolite concentrations of the tumor with therapy outcome. Furthermore, the mechanisms of chemobrain will be investigated by correlating changes in fMRI activation over the treatment cycle with the results of the neuropsychological evaluations.

Chemistry

Reinvestigation of the UV-VIS absorption spectra of the interhalogens, IBr and ICl

Student Presenter: Rachael Stuck

Faculty Mentor: Dr. David A. Dolson

Department: Chemistry

Absorption coefficients of ICl and IBr are of interest, in part because they are photolyzed to produce spin-orbit excited ($2P\frac{1}{2}$) Cl^* and Br^* atoms in energy transfer studies. Notable differences currently exist for the vapor phase ICl absorption coefficients previously reported in scientific literature, and possibly correspond to sample purity. Additionally, only a single gas phase investigation of IBr absorption coefficients has been published. In the present work, great care was used in the preparation of ICl and IBr from stoichiometric amounts of the elemental halogens. Extinction coefficients for

halogen (Cl_2 and Br_2) and interhalogen (ICl and IBr) vapors were determined in the 200 nm – 600 nm spectral range using a diode array spectrophotometer. Results for the elemental halogens are in excellent agreement with current recommendations. Results for the interhalogens will be compared to currently recommended values.

Synthesis of Haplomyrtin Analogs

Student Presenter: Arnoud van Duijn

Faculty Mentor: Dr. William A. Feld

Department: Chemistry

Previous research has shown that the 1-arylnaphthalene lignan lactones occur widespread in nature and have a diverse range of biological activity. A route to the synthesis of Haplomyrtin has been investigated in which 12 separate steps were employed with an overall yield of 13%. In order to improve the total synthesis route and the yield, a novel approach is being investigated. This approach uses phthalide as a starting material. As a preliminary study for the use of an appropriately substituted phthalide in the synthesis of Haplomyrtin, an investigation of the electrophilic aromatic substitution reactions of phthalide as well as the generation of several hydroxy and halo phthalide precursors has been undertaken.

Restricted Rotation in Ortho-Fluorine Substituted Cyclopentadienone and Terephthalate Systems

Student Presenter: Jeff Fogle

Faculty Mentor: Dr. William Feld

Department: Chemistry

Biphenyls and terphenyls systems exhibit rotational barriers with a bulky substituent in the ortho-position. In most cases this

substituent has been methyl groups which give two distinct peaks in the ^1H NMR spectrum due to the mixture of cis and trans diastereomers. The compounds 2,5-dicarboethoxy-3,4-bis(2-fluorophenyl)cyclopentadienone and diethyl 2,3-bis(2-fluorophenyl)terephthalate were synthesized to observe the rotational barrier due to fluorine. The ^1H and ^{13}C NMR spectra show the occurrence of "cis" and "trans" isomers due to the restricted rotation caused by ortho-substituted fluorine.

The Total Synthesis of Haplomyrtin

Student Presenter: Nora Hunter

Faculty Mentor: Dr. William Feld

Department: Chemistry

Haplomyrtin, a 1-aryl-2-3-naphthalide lignan obtained from Turkish Haplophyllum myrtifolium offers a number of synthetic challenges with the incorporation of two aromatic hydroxyl groups at positions 4 and 7 on the naphthalene ring system and regiospecific condensation of the γ -lactone ring. The total synthesis of haplomyrtin is currently being pursued with commercially available vanillin and piperonal in a total of 10 separate steps. All steps have excellent reproducibility with good yields. This strategy includes halogenations of protected vanillin and incorporation of the fully functionalized pendant aryl ring through a lithium-halogen exchange followed by coupling with piperonal. The C-4 hydroxyl group is placed by the in-situ formation of a benzofuran subsequent Diels-Alder reaction with dimethyl acetylenedicarboxylate (DMAD), deprotection and regiospecific reduction of the o-hydroxyester followed by transesterification to close the γ -lactam ring. Investigating the use of 4-methoxy benzyl bromide instead of benzyl chloride as a protecting group, addressing the instability of the secondary alcohol from the coupling reaction with piperonal as well as the

poor yields and difficult isolation of the Diels-Alder reaction product, and completions of haplomyrtin with improvements to the overall yields are the goals of this project.

Synthesis of 1-butoxy-2,5-dicarboethoxy-3,4-diphenylbenzene

Student Presenter: Rachel Sayers

Faculty Mentor: Dr. William Feld

Department: Chemistry

The terephthalate, 1-butoxy-2,5-dicarboethoxy-3,4-diphenylbenzene is an important synthetic precursor to monomers which can be polymerized to form substituted poly(phenylene vinylene)s. Poly(phenylene vinylene)s are capable of electroluminescence and have been used as the emissive layer in organic light emitting diodes. The terephthalate molecule was synthesized with phenyl substituents and a long side chain to allow for increased polymer solubility, and color tunability^{1,2}. Ethynylboronic acid N-methyliminodiacetic acid ester has been a useful tool in the synthesis of 1-butoxy-2,5-dicarboethoxy-3,4-diphenylbenzene in that it both reacts readily to form the boronate protected terephthalate which is easily oxidized to form the phenolic compound, both in good yields. The phenol can then be butylated to form the desired product. This research focuses on the synthesis and identification of multi-substituted terephthalates using ^1H NMR and ^{13}C NMR.

Nanostructured Block Copolymer Systems for Use as Proton Exchange Membranes

Student Presenter: Fadwa Constandinidis

Faculty Mentor: Dr. Eric Fossum

Department: Chemistry

Exploring alternative forms of energy that is both inexpensive and renewable is becoming a vital process required for maintaining a progressive society. Proton exchange membrane fuel cells (PEMFC) are one of the many promising sources currently being explored for this movement. One of the key components in the fuel cell itself is the proton exchange membrane, PEM, that allows the conduction of ions (in this case protons) from the anode to the cathode while preventing the cross-flow of the fuel source (i.e. hydrogen, methanol, ethanol, etc.). This project has focused on comparing the structure-property relationships for two classes of multiblock copolymers. New PEMs, based on a series of sulfonated poly(arylene ether)s, SPAEs, that bear a pendant sulfonic acid group are compared to the much more common SPAEs that bear the sulfonic acid group attached directly to the backbone. The initial phase, and focus of this presentation, involved the preparation of low molecular weight model compounds and their characterization in terms of thermal stability and solubility characteristics. The long term goal of the project is to prepare the corresponding multiblock copolymers and evaluate their proton conductivity and hydrolytic stability.

The effect of super saturation on the Ca and Sr composition in synthetic barite precipitated from seawater

Student Presenter: Dennis Lennaerts

Faculty Mentor: Dr. Steven Higgins

Department: Chemistry

An area of intense chemical oceanographic research effort in the past few decades has been the study of marine minerals as there is ample evidence that buried ocean sediments contain important information on past seawater environmental conditions such as temperature, productivity, alkalinity,

phosphate, and pH, among others. A key oceanic mineral that could hold robust records of seawater Sr and Ca composition is barite. Marine barites typically contain 1-3% Sr and 0.01-0.1% Ca; concentrations that are evidently controlled by conditions under which barite formation occurs thereby potentially linking sediment composition to oceanic chemistry at the time of formation. The key objective of this work is to develop a better understanding of the connection between solution and solid chemistry that will be applicable to natural marine barites over a broad range of environmental conditions. Recent data from our precipitation experiments from natural seawater spiked with BaCl₂ suggest that the Sr/Ca ratio in the barite precipitates is not only a function of the corresponding ratio in seawater via the distribution coefficient, but that super saturation with respect to barite also plays an important role in governing the precipitate composition. We will report the results of barite precipitation experiments carried out in seawater solutions at room temperature as a function of super saturation and as a function of the solution barium ion to sulfate ion ratio. Empirical modeling results from this data will be presented along with the interpretations in terms of the kinetics of ion incorporation during crystallization.

Near equilibrium dissolution of calcite using a flow-through reactor (FTR): Implications for long-term modeling of mineral dissolution in geologic formations

Student Presenter: Michael Mante

Faculty Mentor: Dr. Steven Higgins

Department: Chemistry

In mineral dissolution reactions, surface morphologies play important roles particularly in near equilibrium fluids where generation of new sites of reactivity (e.g., pit nuclei) is thermodynamically disfavored. Following CO₂

injection in geologic formations, dissolution of primary carbonate minerals and crack-sealing cements will occur. The impact of these reactions on fluid chemistry requires better understanding of the reaction kinetics of major minerals at close-to-equilibrium conditions. Initial investigations have focused on quantifying calcite dissolution using short residence time (~ 10 min) flow through reactors to obtain dissolution rates at 60°C, pH = 8.33 and $P_{CO_2} = 3.8 \times 10^{-4}$ atm. Dissolution rates decreased exponentially with time, however, the time to achieve a steady dissolution rate was approximately 120 h, suggesting that surface morphology undergoes significant changes during reaction rate decay. These observations are important in the context of the interplay between surface microtopography and reaction rates and will be discussed in light of atomic force microscopy investigations.

Co-Author(s)/Collaborator(s): Michael Smith, Brittany Campbell

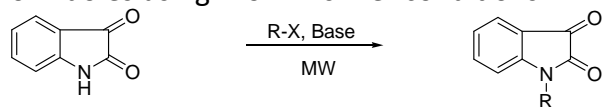
Microwave-Assisted N-Alkylations of Isatins

Student Presenter: Charles Clay

Faculty Mentor: Dr. Daniel Ketcha

Department: Chemistry

In light of the fact that oxindoles undergo alkylation at both the nitrogen and the C-3 position, one route to regioisomerically produced N-alkyl oxindoles involves a two-step process involving N-alkylation of the corresponding isatin followed by reductive deoxygenation of the isatin. We report that isatins can be efficiently N-alkylated using a variety of bases under microwave conditions. These isatins then serve as precursors to oxindoles using Wolff-Kishner conditions.



Small Molecule Caspase Inhibitors using Isatin and Oxindole Scaffolds

Student Presenter: Hagar Abdallah

Faculty Mentor: Dr. Daniel Ketcha

Department: Chemistry

Quinolyl-valyl-O-methylaspartyl-[2,6-difluorophenoxy]-methyl ketone (Q-VD-OPh) is a next generation broad spectrum caspase inhibitor, the effectiveness and reduced toxicity of which can be partially attributable to the carboxyterminal O-phenoxy group as well as the aminoterminal quinolyl groups. We seek to incorporate some of these unique recognition elements onto small molecule, heterocyclic scaffolds such as isatins and oxindoles. Thus, isatins bearing electron withdrawing groups on C-5 and a 2,6-difluorobenzyl substituent have been prepared by analogy to the well studied N-substituted 5-pyrrolidinylsulfonyl isatins. Moreover, 3-benzylidene oxindole derivatives bearing these structural motifs have also been prepared and their effectiveness as apoptosis inhibitors was examined employing human Jurkat T cells.

Co-Author(s)/Collaborator(s): Rebecca Bricker, Chanel Keoni, Thomas L. Brown

Microwave-Assisted Clauson-Kaas Synthesis: A Green Approach to Substituted Pyrroles

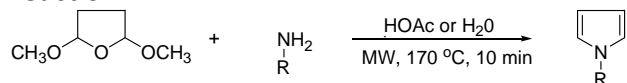
Student Presenter: Kelsey Miles

Faculty Mentor: Dr. Daniel Ketcha

Department: Chemistry

The Clauson-Kaas pyrrole synthesis involving the reaction of primary amines with 2,5-dialkoxytetrahydrofurans is traditionally carried out in refluxing acetic acid for periods of hours to days. The extension to less activated nitrogen nucleophiles such as amides and sulfonamides often necessitates the use of an acidic promoter such as phosphorus pentoxide, thionyl chloride or triflic acid. We find that under microwave conditions, the preparation

of N-substituted pyrroles can be effected (5-10 min) in green conditions using water or acetic acid. Furthermore, we compare our method with a previously published solventless microwave approach using montmorillonite K-10 clay. The ease and efficiency of this process indicates this heterocyclic ring synthesis is well suited for adaptation in an undergraduate laboratory setting demonstrating the use of microwaves in a green heterocyclic ring forming reaction.



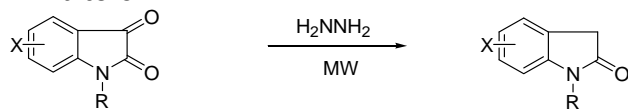
Microwave-Assisted Wolff-Kishner Reductions

Student Presenter: Paul Repasky

Faculty Mentor: Dr. Daniel Ketcha

Department: Chemistry

The Wolff-Kishner reduction normally proceeds in a two step fashion involving initial hydrazone formation followed by a base catalyzed reductive elimination of nitrogen. We now report that the microwave assisted Wolff-Kishner reduction can be used for the preparation of multiple oxindole derivatives reduced from isatin with 80% wt. hydrazine hydrate at 120 °C. The reduced products can then undergo aldolization at the 3-position with a variety of aromatic aldehydes to afford benzylidene oxindoles which have a variety of biological activities including protease inhibitors.



Microwave Assisted Michael Additions of N-(Arylsulfonyl)pyrroles

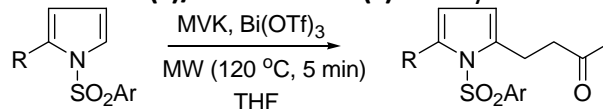
Student Presenter: Venkateswarareddy Karrepu

Faculty Mentor: Dr. Daniel Ketcha

Department: Chemistry

The Michael type addition of methyl vinyl ketone (MVK) to pyrroles bearing strongly electron withdrawing N-protecting groups (e.g., arylsulfonyl) have yet to be reported. We find that such alkylative processes can be effected in moderate yields using metal triflate catalysts in conjunction with microwave irradiation. Optimization of reaction conditions indicates that of the catalysts examined (rare earth triflate and chlorides) and solvents (nitromethane, acetonitrile, dichloroethane, methanol, etc.) highest yields of mono-alkylated derivatives are obtained using bismuth triflate (10 mol%) in tetrahydrofuran as solvent. Similar attempts employing acrylonitrile or ethyl acrylate failed to produce appreciable alkylation.

Co-Author(s)/Collaborator(s): Kelsey Miles



Comparison of Atmospheric PAH Profiles in Pine Trees and High-Volume Samplers and the Determination of Source Apportionment

Student Presenter: Timothy Tomashuk

Faculty Mentor: Dr. Audrey McGowin

Department: Chemistry

This study examined the bias between plant (passive) and high-volume samplers (active) by comparing the PAH profiles of each over a period of three months. A comparison of PAH profiles collected on filters in high-volume samplers (active sampler) with Austrian pine needles and white pine (passive samplers) was done in Moraine and Yellow Springs, OH. The sampling of Moraine has taken place over period of 7 months with samples collected every other month. Yellow Springs samples

have been collected over a 6 month period every other month. Diagnostic ratios of PAH concentrations were calculated for comparison of source apportionment between the two sites and sampling methods. The profiles of filters and pine needles varied. Filters collected more of the high molecular weight compounds while the pine needles collected the lighter molecular weight compounds. The profiles were similar in that fluoranthene was the highest in concentration of the lighter compounds for each month. In all cases the amount of PAHs collected on filters was greater than in the pine needles on a dry weight basis. The mass of PAHs the needles collected ranged from 1.16 $\mu\text{g/g}$ –4.38 $\mu\text{g/g}$ while the filters ranged from 161.53 $\mu\text{g/g}$ –436.33 $\mu\text{g/g}$. The filters collected on average 120 times more PAH mass than the pine needles. Source apportionment for filters and pine needles did not always agree. The filters indicated a stationary source (incinerators) with a mass ratio (202) of 0.52 or higher for the three months sampled. The pine needles indicated a mobile combustion sources such as cars and truck traffic for August and October with a mass ratio (178) of 0.08.

Identification of Sea Turtle Leeches Using DNA Barcoding

Student Presenter: Triet Truong

Faculty Mentor: Dr. Audrey E. McGowin

Department: Chemistry

Fibropapillomatosis (FP) is a panzootic plaguing all species of sea turtles with green turtles (*Chelonia mydas*) having the highest percentage of infection. Although fibropapilloma-associated turtle herpesvirus (FPTHV) has been identified as the causative agent of FP, the primary vector triggering this chronic tumor-forming disease is still unknown. Parasitic marine leeches (*Ozobranchus* spp.) could be a potential mechanical vector behind the emergence of this panzootic, although it is

uncertain if it is species specific. *Ozobranchus* spp. are very small and difficult to distinguish anatomically, and until now, there have been few attempts to document them. DNA barcoding using mitochondrial cytochrome oxidase I (COI) gene as a molecular marker is a tool for identifying organisms and is especially useful for sea turtle leeches. Two species of leeches present along the Florida coast are *Ozobranchus branchiatus* and *Ozobranchus margoii*. The typical hosts reported for *O. branchiatus* and *O. margoii* are green and loggerhead (*Caretta caretta*) sea turtles respectively. DNA barcoding was applied to samples of both species of leeches obtained from Melbourne Beach and the St. Lucie Nuclear Power Plant in Florida. *O. margoii* is already present in the NCBI GenBank (AF003268), but leeches morphologically identified as *O. branchiatus* did not have a match in the genetic database. As a result, we used our DNA sequencing to add the *O. branchiatus* leech as a new species to GenBank (GU985465 and GU985466). There was a small but significant variance between the DNA sequences of the *O. branchiatus* leeches found on green and loggerhead sea turtles, respectively from Melbourne Beach and St. Lucie. The fact the *O. branchiatus* leech has changed specificity serves as an indication as to why the panzootic affecting mainly *C. mydas* initially has now appeared to a lesser degree in other turtle species.

Synthesis and characterization of silver nanoparticles for SERS-based biosensing

Student Presenter: Allie Meyerhoefer

Faculty Mentor: Dr. Ioana Pavel

Department: Chemistry

Colloidal silver nanoparticles (AgNPs) were synthesized via reduction of silver nitrate with sodium borohydride using a slightly modified Creighton method. AgNPs were then

characterized and using UV-VIS absorption spectrophotometry, transmission electron microscopy (TEM), flame atomic absorption spectroscopy (FAAS), fluorescence spectroscopy, Raman and surface-enhanced Raman spectroscopy. The UV-VIS absorption spectra presented a sharp maximum at 400 nm indicating a minimal aggregation. The TEM images and size histograms prepared by analyzing 400 AgNPs indicated that the AgNPs were spherical with an average diameter of about 11 nm and a narrow size distribution. FAAS data demonstrated a high reaction yield and allowed for the quantification of the amount of AgNPs produced (i.e., 15.31 ppm). Raman spectra helped confirmed the purity of the AgNPs. Surface-enhanced Raman spectroscopy measurements were performed using the rhodamine 6G (R6G) dye at various concentrations to evaluate the sensing efficiency of these colloidal AgNPs. The analytical - (7.3×10^4) and surface-enhanced Raman enhancement factors (5.1×10^1) were calculated based on the Raman, SERS, and fluorescence spectra at a R6G concentration of 10^{-6} M. In conclusion, the proposed synthesis method led to the formation of colloidal AgNPs of highly uniform size and shape, minimal aggregation and SERS-based biosensing potential similar to other colloidal nanoparticle systems described in the literature.

Co-Author(s)/Collaborator(s): Jennifer Monahan, Kent Weaver, Zachary Arnold, Marjorie Markopoulos

Toxicity of platinum group metals in chick embryo tibiotarsi by micro-Raman spectroscopy

Student Presenter: Jennifer Monahan

Faculty Mentor: Dr. Ioana Pavel

Department: Chemistry

Platinum group metals (PGMs) have been shown to accumulate in various tissues of

organisms but their toxicity is not well-known. Raman spectroscopy is a powerful analytical technique that enables direct and non-destructive chemical characterization of bone tissues and can also address tissue heterogeneity issues. PGMs were injected into chick embryos in the following concentrations: 0.1, 1.0, 5.0, or 10.0 ppm solutions of Pt (IV), Rh (III), Pd (II) or PGMs mixtures. The micro-Raman maps recorded on the paraffin embedded tibiotarsus cross-sections showed significant changes in the chemical composition and structure of the bone tissue as a result of PGMs exposure of 1 ppm or higher (i.e., anomalous calcium inclusions impeding circulation in cartilage matrix). The following bone properties were analyzed and quantified: a) age of mineral crystals and carbonate content, b) degree of mineralization of the collagen matrix and possible losses in the organic/inorganic bone components and c) mineral crystallinity. The X-ray fluorescence images indicated a qualitative decrease in the calcium and phosphorus content across the tibiotarsi surface with the increase in the PGM amount.

Co-Author(s)/Collaborator(s): Kent M. Weaver, Britney NeJame, Jacob Cowley, Robert Slaughter, Larry Burggraf, Zofia Gagnon

Size Selection and Concentration of Silver Nanoparticles by Tangential Flow Filtration for SERS-Based Biosensors

Student Presenter: John Trefry

Faculty Mentor: Dr. Ioana Pavel

Department: Chemistry

Silver nanoparticles (AgNPs) have received tremendous attention for their unique properties as ultrasensitive surface-enhanced Raman spectroscopy (SERS)-based biosensors. One of the main challenges in SERS-based biosensing is to fabricate colloidal AgNPs that are non-hazardous, non-toxic, reproducible, stable, and at low energy costs. AgNP size and

aggregation state are typically controlled during synthesis through the use of chemically aggressive surfactants, stabilizers, and capping agents, which are not suitable for biological applications. To determine a method for overcoming these disadvantages, a slightly modified Creighton colloid was subjected to two methods of isolation: ultracentrifugation and tangential flow filtration. The resulting colloids were examined by transmission electron microscopy, UV-Vis absorption spectrophotometry, SERS, fluorescence and flame atomic absorption spectroscopy (FAAS). Ultracentrifugation yielded a suspension containing both AgNPs and AgNP-aggregates, which were 2.5 fold larger in size and had a 2.0 fold greater size distribution than the monomers in the filtration method. The UV-Vis absorption spectra confirmed these differences. FAAS showed that the concentration of AgNPs obtained by filtration and ultracentrifugation were 198.7 $\mu\text{g mL}^{-1}$ and 77.4 $\mu\text{g mL}^{-1}$, respectively. The analytical (8.1×10^7) and surface enhancement factors (7.9×10^4) corresponding to the final AgNP filtration were similar to those determined for AgNP ultracentrifugation. These factors were calculated based on the SERS and fluorescence spectra for an analyte (rhodamine 6G) concentration of 10^{-6} M. Both methods had a 1,000 fold improvement in SERS-sensitivity as compared to the original colloid. However, the filtration method provides size-specificity and minimal aggregation in a highly concentrated colloidal suspension of AgNPs.

Co-Author(s)/Collaborator(s): Jennifer L. Monahan, Kent M. Weaver, Allie J. Meyerhoefer, Marjorie M. Markopolous, Zachary S. Arnold, Dawn P. Wooley

Acylation of Sydnones Using Montmorillonite K-10 Clay and a Variety of Anhydrides: Thermal vs. Microwave Irradiation

Student Presenter: Amber Rumple

Faculty Mentor: Dr. Kenneth Turnbull

Department: Chemistry

A variety of 3-phenyl-4-acylsydnone were synthesized using Montmorillonite K-10 clay as catalyst and a variety of anhydrides (Scheme 1). The efficiency of thermal heating versus microwave irradiation was explored. Thermally, the acylated sydnones were synthesized in good yields after a time period of 24 hours, for the simplest anhydrides, and up to many days for the more complicated anhydrides. With the use of microwave irradiation the rate of the reaction was significantly increased bringing reaction times down to mere hours. The scope and limitations of the process will be discussed. Scheme 1: General scheme showing acylation of 3-phenylsydnone.

College of Nursing and Health

Collaborating through Telecommunication to Improve Health Outcomes for the Diabetic School Child

Student Presenter: Debra Stoner

Faculty Mentor: Dr. Tawna Cooksey-James

College of Nursing and Health

Diabetes is a common chronic disease of children managed in school settings. Providing care for the diabetic school child can be challenging, which increases when coupled with little communication between the nurse, primary care provider and the parent regarding the child's diabetic care for seven hours daily. The purpose of this study is to improve the health care of school children with type 1 diabetes through the collaboration of primary care providers, parents of a diabetic school child and the school nurse. The researcher hypothesizes that using telecommunication will increase collaboration between the parent, primary care provider and school nurse, and that increased communication will correlate

with fewer glycemic events during the school year. The target population will be first through fifth graders with type 1 diabetes. This nonprobability sampling plan requires each participant to be a school child with type 1 diabetes requiring insulin during the school day and a parent who agrees to use telecommunication and who signs an informed consent and provides permission to contact the primary care provider. In this quantitative research, two correlational analyses will be done: 1) between the concepts telecommunication and collaboration, and 2) between the frequency of communication and number of glycemic events. This longitudinal study will use the first three months of school to collect baseline data and the last 6 months for intervention with data collection at midpoint and the end. The results of this research will be useful to the school nurse, parent and primary care provider in planning for the care of the diabetic school child and will provide a model for collaboration. Furthermore, research of communication programs to improve health outcomes meets an objective for Healthy People 2010: Health Communication.

Treatment and prophylaxis of CVC infection in pediatric patients with short bowel syndrome: Ethanol lock versus antibiotic lock

Student Presenter: Jennifer Lewis

Faculty Mentor: Dr. Tawna Cooksey-James
College of Nursing and Health

Children with pediatric short bowel syndrome (SBS) face many complications with CVC (central venous catheter) infections among the most common. Current treatment options for CVC infections include systemic antibiotic therapy, ethanol lock therapy (ELT), and antibiotic lock therapy (ALT). The goal of this study is to determine which treatment option,

ALT or ELT, is most effective in the treatment of CVC infections as indicated by decreased number of infection days, decreased infection recurrence, decreased removal of the CVC line, and the fewest side effects. The hypothesis is that ELT will be more effective than ALT in the treatment of CVC infections in all of these indicators. This quantitative study uses an experimental research design with a control group receiving a normal saline lock, and two randomized treatment groups receiving either ALT or ELT. All study participants will receive systemic antibiotics, which is the standard of care for CVC infections. The sample criteria includes the following: children under 18 years of age with a documented diagnosis of SBS, an indwelling CVC for at least 48 hours, hospitalization with positive blood cultures indicating a CVC infection, and no allergies to vancomycin or ethanol. The convenience sampling will continue until 45 children have been assigned evenly to the three study groups and after parental signatures for informed consent are obtained. Collected data will focus on the four indicators that determine effective treatment and will be analyzed using mean, standard deviation, and ANOVA. Effective treatment of CVC infection could lead to significant improvement in the care of children with SBS. Evidence that one therapy is more effective in the treatment of CVC infection could lead to nursing practice changes and a decrease in childhood morbidity and mortality due to CVC infection.

Burnout in Nursing Units Throughout the Hospital: No Longer Limited to Critical Care

Student Presenter: Katherine Hoying

Faculty Mentor: Dr. Tawna Cooksey-James
College of Nursing and Health

Nursing burnout, which negatively affects the nurse's quality of life and the quality of care delivered to the patient, is a problem that has

been associated with stresses inherent in the critical care environment. However, with continued changes in the health care system and as additional roles and stresses are added to nurses it appears that nursing burnout is expanding as well. The purpose of this study is to determine the extent of burnout within one hospital. The proposed quantitative study will obtain demographic data identifying the characteristics of the nursing unit and will use the 16-item Maslach Burnout Inventory to assess burnout. Data will be collected over one month from all Registered Nurses (RNs) who sign an informed consent and who work as staff nurses directly involved in patient care throughout all units located in a 190-bed Midwest hospital. Data will be analyzed to determine if burnout is being experienced and whether the experience is mild, moderate, or severe. Additionally, the inventory will analyze the burnout in terms of the breakdown of three components associated with burnout: emotional exhaustion, depersonalization, and cynicism. Comparisons will be made of the results throughout all of the units in the hospital, focusing on the percentage of nurses experiencing burnout, the degree of burnout being experienced, and the burnout components involved. In this research two hypotheses have been proposed. The first hypothesis is that burnout occurs in nurses in all units of a hospital. The second hypothesis is that units in a hospital providing critical care will have higher degrees of burnout in nurses than units not providing critical care. This research has implications for the care of nurses in the workplace. Future studies will focus on identifying interventions for the alleviation of nursing burnout specific to the hospital unit.

Donor Milk, Mother's Breast Milk, and Infant Formula: A Comparison of Preterm Infant Nutritional Outcomes

Student Presenter: Kimberly Joo

Faculty Mentor: Dr. Tawna Cooksey-James
College of Nursing and Health

Although mother's breast milk is considered the best nutritional source for both term and preterm infants, as many as 25% of all preterms do not receive their mother's breast milk. In the absence of the best nutritional source, vulnerable preterms need the best alternative nutritional source. The purpose of this study is to determine the differences in the nutritional outcomes of weight gain, length gain, head circumference, infection rate, and length of hospital stay for preterm infants fed with either mother's own milk, donor human milk, or cow's milk-based infant formula. Three study hypotheses incorporate findings from the literature regarding the nutritional outcomes associated with the three types of preterm feedings indicating differences not only between donor milk and infant formula, but also mother's breast milk and donor milk. The sample for this quasi-experimental study will be preterm infants born in three local hospitals at 24 to 37 weeks gestation. After obtaining a signed informed consent from the mothers, each preterm will be placed in one of three groups based on the mother's preference. Mother's who choose to breast feed will comprise group 1; while preterms placed in Groups 2 or 3 will receive donor human milk or infant formula, respectively, with Group 3 functioning as the control group. The dependent variables of weight and presence of infection will be documented at the bedside daily. The dependent variables of head circumference and height will be measured and documented at the bedside each week. Upon discharge, the total number of hospital days will be calculated for each infant. Outcomes for each group will be compared using ANOVA statistical analysis. The results of this study will assist in the determination of the best alternative source of nutrition for preterm infants when mother's own milk is unavailable.

Literature Review: Depression in Palliative Care Patients

Student Presenter: Elizabeth Yeager

Faculty Mentor: Jane Doorley

College of Nursing and Health

Problem: There is a high level of depression in the Palliative Care Patient population that goes undiagnosed and untreated. **Purpose:** This literature review evaluates articles and research studies available discussing the presence, risk factors, assessment, diagnosis, and treatment of depression in the palliative care patient population. **Objectives:** Identify areas where the research and knowledge is lacking and make recommendations for further research. Identify areas of clinical practice affected by the findings discussed in the articles and what nurses should know. **Approach:** Select and evaluate recent articles for content as well as quality of research processes. **Results:** Research shows that there is an increase in the prevalence of depression in the palliative care population, a large percent undiagnosed. There are a variety of risk factors contributing to the development of depression and several tools are currently be adapted to screen for depression in the palliative care populations addressing population specific concerns. Treatment includes psychotherapies and antidepressant pharmaceuticals; however research is limited due to the physical condition of the patients. **Conclusion:** There are several recommendations for further research in this area. The first is developing a screening tool that is quick, efficient, and is easy for even severely debilitated patients to complete. The second, to examine the benefits and side effects of pharmaceuticals in the population addressed within ethical parameters. Third is education of nurses in current literature and available tools and the application among nurses to decrease the number of patients whose depression goes unrecognized and therefore untreated.

Implementation of Evidence Based Practice Change Using Computer Based Education To Improve Asthma Compliance In 7-12 Year Olds

Student Presenter: Gwen Kaegy, Tami Laco

Faculty Mentor: Dr. Barbara Fowler

College of Nursing and Health

Significant numbers of children in the U.S. are affected by asthma resulting in poor airway exchange, increased risk of respiratory infections, and equated with increased school absenteeism and emergency room (ER) visits. Effective asthma management requires prompt treatment regimen and timely recognition of triggers that exacerbate symptoms. Evidence from literature indicates that tailored, interactive computer based asthma education in the privacy of the home improves health outcomes, increases self-management skills, and decreases healthcare utilization. The burning question is: does a 6-month in-home, interactive computer asthma educational program increase self-regulatory actions, asthma-specific behaviors, and confidence in pediatric asthma management decision-making? Project planned, measurable objectives stated, and conceptual framework applied: The Practice Change includes a 6-month in-home, interactive computer asthma education program offered in conjunction with a military treatment facility in the Midwest to encourage self-management of asthma in children 7-12 years. Purposive, convenience sampling of 30 children will be done by the nurse researcher during a routine clinic visit. Permission will be sought from parents/guardian to access their child's medical records and keep a diary recording school days missed. Bartholomew, et al.'s 23-item questionnaire measuring self-regulatory actions (taking medications), asthma-specific behaviors (environmental triggers monitoring), and confidence in asthma management decision-

making will be used at the intervention onset and again in 6 months. A nurse researcher will provide individual instructions on using the asthma education program. Pediatric clinic phone numbers will be provided for questions regarding the educational intervention. Social cognitive theory is appropriate for this intervention because it posits that learning is enhanced in a nonthreatening environment that provides interactive teaching/learning. Evaluation of project: EBP intervention success will be determined by pre-and-post-test evaluations measuring change in confidence in performing self-regulatory, asthma-specific behaviors and diary/medical records review for asthma-related school absences and ER visits.

Text Messaging and Note Card Reminders to Decrease the Rates of Missed Appointments in a Women's Public Health Clinic

Student Presenter: Suzanne Brooks

Faculty Mentor: Dr. Barbara Fowler
College of Nursing and Health

High missed appointments (HMAs), resulting in missed opportunities to identify potential health threats affecting pregnancy outcomes, are a major concern for a local women's health clinic serving prenatal clients in the Dayton area. HMAs has been linked to forgetfulness and apathy resulting in no show rates between 14.7% - 55% per/month. The literature review indicated that numerous reminders, combined with text messaging and personal note cards are more effective than single reminders in reducing HMA rates. This innovative approach encourages prenatal patients to assume greater responsibility for their health and their child's well-being. For example, an initiative by The National Healthy Mother, Healthy Babies Coalition, Text4baby, encourages timely prenatal care using text messaging. In collaboration with the women's health clinic,

this author incorporated the Centers for Disease Control, Planned Approach to Community Health (PATCH, 1992) to engage community members in the planning. The framework posits that effective and sustainable interventions should be derived from the "voices" of community stakeholders. Therefore, a focus group of women from the community will be established to determine the likelihood of success of implementing a new text messaging and note card reminder protocol. Based on their feedback, staff at the clinic will be oriented to the new client reminder system. Evaluation of the new protocol will include monitoring the percentage of missed appointments, examining staff's involvement and the user-friendliness of written materials used during the new protocol. All data will be monitored by the master's prepared advanced practice nurse in community/public health at 3, 6, and 9 months. Revisions or modifications of the new protocol will be made as needed at the end of each evaluation period. This analysis will determine the success of the text messaging and personal card reminder system derived from the author's program planning assignment. A redesign or termination of the program will be based on outcome data.

Physical Activity Preference and Body Mass Index among Adolescent Females

Student Presenter: Don Potter

Faculty Mentor: Dr. Perla R. Ilagan
College of Nursing and Health

Researchers have observed that a dramatic decline in physical activity (PA) occurs during adolescence and that up to one third of high school students fail to meet established physical fitness guidelines (Robbins, Pis, Pender, & Kazanis, 2004). This sedentary trend predisposes teens to obesity. A review of the literature yields many commonalities, notably

researchers' concern for future morbidities fostered by youth obesity, including insulin resistance, metabolic syndrome, diabetes mellitus, hyperlipidemia, and hypertension (Lee, Chou, & Lai, 2007). Programs such as Robbins, Gretebeck, Kazanis, and Pender's (2006) Girls on the Move sought to address these concerns. The purpose of this study is to examine whether level of preference for active versus sedentary PA among adolescent females is correlated with their body mass index (BMI). This quantitative, non-experimental, correlational study proposes that a convenience sample of teenage girls (n = 36) who meet inclusion criteria and self-report an active physical activity preference will have a lower BMI. The target population is a Midwest metropolitan area with 31,165 adolescent females. The accessible population is the 1,255 13 to 17 year-old adolescent females enrolled in the pediatric clinic of a Midwestern medical center. The theoretical framework supporting this proposal is Nola Pender's Health Promotion Model, specifically the relationship between the biologic trait of obesity and the behavior-specific cognition of competing preferences as a barrier. Data collection includes BMI measurement, a demographic questionnaire, and Pender's Immediate Competing Preferences Profile questionnaire (Cronbach's alpha .83). This tool is the least documented of Pender's research instruments, and a tacit goal of this study is to contribute to this body of knowledge. Today there are many sedentary activities that compete with active PA for teenagers' time and attention. Nurses who are aware of adolescent girls' activity preferences can more effectively motivate them toward healthy behaviors.

Depression and its Relationship to Suicidal Ideation in the Elderly

Student Presenter: Joe Bertke

Faculty Mentor: Dr. Perla Ilagan

College of Nursing and Health

Depression is one of the most prevalent disorders affecting the elderly that is often unidentified and/or insufficiently treated in our aging population. Depressive symptoms often go unnoticed and manifest themselves as somatic complaints from the elderly and are often misdiagnosed as normal physiological changes of aging. As diagnoses of depression are overlooked or missed, the elderly are subject to a higher risk for feeling hopeless or helpless and hence may develop thoughts of self harm or suicidal ideation (Suter, Suter & Johnston, 2008). The proposed study will examine the presence of depression and suicidal ideation in the elderly. This has important implications for nursing in developing the knowledge base to recognize depression and suicidal ideation in the elderly and in implementing interventions that may help this particular population. The setting for this study will take place at the Sunset Senior Living Center in the Midwestern United States. The sample will comprise 75 male and female residents ages 65 to 75. Data will be collected utilizing the Geriatric Depression Scale (GDS) with a reported reliability of Cronbach's Alpha = .89 (Lopez, Quan, & Carvajal, 2010), and the Suicidal Ideation Scale (SIS) which yields a Cronbach's Alpha of .90. The SIS is moderately related to depression and hopelessness (Rudd, 1989). The study will use a cross-sectional correlational design to support the hypothesis that depression will be positively correlated to suicidal ideation. It is vital for health professionals to recognize the signs and symptoms of depression and suicidal ideation in the elderly so that interventions can be put in place.

A Comparison between the Full Outline of UnResponsiveness Scale (FOUR Score) and the Glasgow Coma Scale (GCS) in Determining Triggers for Organ Donation

Student Presenter: Karen Scott

Faculty Mentor: Dr. Perla Ilagan
College of Nursing and Health

Many lives are saved through organ donation. Nurses are often the first to recognize potential donors, which makes it important to improve the referral process. This proposed study will help determine if the new neurological assessment tool, the Full Outline of UnResponsiveness Scale (FOUR Score) initiates more referrals to the organ procurement organization than the other neurological assessment tool, Glasgow Coma Scale (GCS).

High-Fidelity Simulation in Nursing Education: Perspectives of Undergraduate Nursing Students: A Research Proposal

Student Presenter: Patrick Moser

Faculty Mentor: Dr. Perla Ilagan
College of Nursing and Health

Undergraduate nursing education programs are facing increased enrollment, faculty shortages, and a decrease in the availability of clinical sites. Faculty members in these programs must find new and innovative strategies to ensure students are prepared for the challenges of providing care for more complex patients, many of whom have chronic multisystem disorders. This proposed study will examine student perceptions of how simulation can be used in undergraduate nursing education. Information from this study may guide future implementation of simulation in order to improve undergraduate nursing education curricula. This study will take place at a College of Nursing in the Midwestern United States which has embraced the use of simulation as a core component of the curriculum for

undergraduate nursing education. A grounded theory approach will be used for the study. Data will be collected from interviews of junior and senior students who have recently completed or are in the process of completing a course which uses simulation to teach clinical and critical thinking skills. Data will be analyzed to determine central concepts based on student perceptions. These central concepts will be used to develop strategies for future use of simulation technology. This study might benefit administration and faculty members of undergraduate nursing programs as they strive to create new strategies to improve nursing education with a focus on using clinical simulation in the classroom. Potential teaching and learning strategies implemented with information from this study might benefit current and future nursing students by providing them with a safe environment to practice clinical skills, critical thinking, and communication within the multidisciplinary health care team. Patients will potentially benefit from the care given by nurses with improved skills and experience with providing care using modern technology and techniques of nursing.

The Effect of Satisfactory Patient Education on Patient Compliance: Evaluation of Readmission Rates on Post-Op CABG Patients

Student Presenter: Ruby Mariam

Faculty Mentor: Dr. Perla Ilagan
College of Nursing and Health

Post operative Coronary Artery Bypass Graft (CABG) patient readmission rates are increasing in an alarming rates and one of the reasons is that healthcare workers are not meeting the individual patient education needs at the time of hospitalization. The process of educating effectively is somewhat a vague concept for health care workers. According to Dunckley et

al. (2008), the more relevant the education content provided to the patient, the more likely that it will produce the changes that will lead to better outcomes such as post-operative self care behaviors. The objective of the proposed study will be to evaluate the effectiveness of patient education provided by health care workers on the level of patient compliance as it relates to the readmission rates of post operative CABG patients. A quantitative descriptive correlation design will be used for the study. The subject recruitment will take place in discharge units from two Midwestern hospitals. Subjects for the study will be male and female CABG patients who are being discharged home. The approximate number of subjects will be 200 with consideration for mail-in survey (increased by 60%) and also increased by 20% after assigning 30 subjects for each variable. The proposed study will be supported by Orem's theory of self-care. Data collection will include a mail-in-survey questionnaire that consists of Patient Learning Needs Scale (PLNS) and also a demographic questionnaire. All the PLNS items were internally consistent with a Cronbach's alpha coefficient of 0.87 (Fredericks et al., 2009). In addition, readmission rate will be monitored by having a registry that will be active in all the Midwestern area hospitals within 200 mile radius. In conclusion, health care workers who individualize patient education will contribute to better patient self care behaviors in post-CABG patients.

Pathway To Student Scholarship

Student Presenter: Connie Barnes, Eva Berry, Katie Conrad, Mary DeCoursey, Nick Emrick, Scott Gebele, Stephanie Gossman, Audrey Lozier

Faculty Mentor: Dr. Anne Russell and Dr. Kathy Keister

College of Nursing and Health

The pathway to student scholarship for second-degree accelerated nursing students involved a writing-across-the-curriculum assignment that spanned two quarters. Students integrated content from nursing informatics, principles of nursing research and complex clinical nursing problems. During the first quarter, students were enrolled concurrently in a graduate level nursing informatics course and an undergraduate nursing research course. Students learned to access, search, and critically appraise the professional nursing and allied health literature through multiple assignments. The focus of the second quarter was to continue building on previous assignments and to develop a scholarly manuscript suitable for publication in a peer-reviewed professional nursing journal. Two faculty members worked collaboratively with student authors, providing feedback and guidance on multiple drafts of their manuscripts. Faculty participated in the identification of and submission to an appropriate journal based on topic and target audience. Eight students developed high quality manuscripts. To date, one manuscript has been accepted for publication in a professional nursing journal, and seven manuscripts are under review.

Topic	Journal	Status
Animal-Assisted Therapy in Critical Care	<i>Dimensions of Critical Care Nursing</i>	Accepted
Telehealth and Managing Patients with Cardiovascular Disease	<i>Journal of Cardiovascular Nursing</i>	Under Review
Genetic Counseling in Breast Cancer Assessment	<i>Nursing for Women's Health</i>	Under Review
Enhancing Communication with Parents of Premature Infants	<i>Advances in Neonatal Care</i>	Under Review
Needs of Parents of Critically Ill Children	<i>Journal of Pediatric Nursing</i>	Under Review

Topic	Journal	Status
Reminiscence Therapy in Older Adults	<i>Journal of Gerontological Nursing</i>	Under Review
Bariatric Surgery and the Pregnancy Experience	<i>Nursing for Women's Health</i>	Under Review
Sleep Promotion for Athletes	<i>Journal of Community Health Nursing</i>	Under Review

Comparison of Injury in College Student-Athletes and College Student Non-Athletes: Analysis of a National Sample

Student Presenter: Nicole Kamann

Faculty Mentor: Dr. Elizabeth Sorensen
College of Nursing and Health

The presence of pain during exercise signals potential injury and elicit an avoidance response to decrease pain and minimize extent of injury. For the college student-athlete, pain and injury are often expected. Current sports medicine literature focuses on treatment for acute physical injuries, with the goal of returning the college student-athlete to participation quickly as possible. The literature on pain and injuries in college student non-athletes focuses on social risks associated with pain and injury. This suggests that compared to college student non-athlete, student-athletes may have more injuries; however, research comparing the two groups was minimal. The purpose of this study was to determine the difference in injury between student-athletes and college student non-athletes. The Fall 2008 American College Health Association National College Health Assessment II survey database (N = 20773) was analyzed to compare student-athletes (n = 2241) to college student non-athletes (n = 18532). Inclusion criteria were full-time students ages 18-24 to reflect national athletics participation requirements. Chi-squared tests determined between-groups differences to five NCHA II items describing

back pain, broken bone or sprain, repetitive stress injury, chronic pain, and fracture, sprain, strain, or cut. T-tests determined between-groups differences to an Injury variate made up of the five items. Compared to college student non-athletes, significantly more student-athletes reported back pain, broken bone or sprain, repetitive stress injury and fracture, sprain, strain, or cut. Compared to college student non-athletes, significantly more student-athletes reported injury. Despite national policies and considerable university fiscal resources committed to improving safety and reducing injury in college athletes, significantly more athletes than non-athletes reported injuries. Further research is needed to determine short term effects beyond “return to play”, e.g. academic impediments related to injury, and long term effects on health, quality of life and career productivity.

Teddy Bear Wellness

Student Presenter: Jennifer Grogg, Ashley Giesige, Rebecca Shubach, Tiffany Stump

Faculty Mentor: Dr. Ann M. Stalter
College of Nursing and Health

Teddy Bear Wellness is a nursing student designed and implemented program for children ages 5-7years. The program is offered as a summer camp in collaboration with the Office of Pre-College. Children are socialized into the career of nursing in an action packed, fun-filled week of structured activity. Teaching and learning theories guide learning. Concepts of altruism, infection control, safety, and excellence are reinforced with Care Coins, Glo-germs, Emergency Day, Graduation and of course, Teddy Bears! Wright State Interdisciplinary teams include Campus Security, Campus Recreation, Wheel Chair Basketball Team, and Anatomy lab. Community Partners include Children’s Medical Center and Fairborn Fire Department. Area school systems support scholarships for disadvantaged youth.

The poster presents a photogallery of the children having fun with Teddy Bears while learning the art and science of nursing.

Parent Perceptions of the Rural School's Role in Addressing Childhood Obesity

Student Presenter: Jessica Steinke, Rosanta Barker

Faculty Mentor: Dr. Ann M. Stalter
College of Nursing and Health

Background: Child obesity in United States is epidemic (Institute of Medicine, 2009). Among children ages 6-11 years obesity prevalence has increased 17.5% in 30 years. Underprivileged, minority children are at most risk (2:5) (Lugwig, 2007). Rural children have comparable trends (Schetzina, et al., 2009). Consequences of child obesity are expressed in chronic adult diseases (Nihizer, 2007). Economic burden of chronic disease exceeds \$120,000 billion (Sharma, 2006). Parents shoulder responsibility their child's health by providing access to routine screenings, availability of nutritious foods, limiting video/screen viewing time, and encouraging active lifestyles (Ludwig, 2007). Schools and teachers also have a stake in child health. There is ambiguity in whether parents favor school assistance in routine screening for child obesity (Murphy & Polivka, 2007). That is, some parents view Body Mass Index (BMI) screening as protective and some view it as a barrier. Rural school nurses experience barriers to BMI screening and need to understand parental perceptions for using BMI as a prevention measure (Stalter, 2010). Exploring parents' perceptions from rural schools may increase understanding how geography is a barrier to BMI screening. Purpose: To gain understanding of parental perceptions of rural school's role in obesity prevention. Specific Aims: 1). Identify parental perceptions regarding causes of obesity and use of BMI screening in a rural school; 2). Identify parental

preferences receipt of BMI information in a rural school; and, 3). Identify parental perceptions of the rural school's role in prevention of childhood obesity. Methods: Descriptive and will use survey research design. Instrument: "Parental Perceptions of Body Mass Index and Obesity in School-Age Children" questionnaire will be used (Murphy & Polivka, 2007) Internal reliability and content validity have been established (Cronbach's alpha, $r=.80$). Sample. Convenience sample, comprised of parents with children in a northwestern rural Ohio elementary school. Procedures: pending WSU-RSP/IRB approval.

Computer Science and Engineering

A qualitative Examination of Topical Tweet and Retweet Practices

Student Presenter: Hemant Purohit

Faculty Mentor: Dr. Amit P. Sheth

Department: Computer Science & Engineering

Twitter's popularity in harnessing real-time traffic, enabling large-scale information diffusion and creating tangible effects on participating economies and societies is well known today. Just minutes after President Obama's address to Congress on healthcare, Twitter showed an avalanche of tweets about the outburst from Joe Wilson – and not inconsequentially, financial support began pouring into the campaign funds of both Joe Wilson and his opponent. Twitter's influence was also apparent following the terrorists attack in Mumbai, Haiti earthquake and in the civil reaction to the Iranian elections. Although it has been argued that, as with link-based blogging, re-tweeting (forwarding of a tweet) holds immense potential for viral marketing and content sharing, the mechanics of this practice is not well understood. We hypothesize that in addition to the social significance or timeliness of a tweet, there this

is also a strong three-dimensional dynamic at play – the people involved (passionate advocate or an objective observer), the content being tweeted (fact-sharing or emotionally charged) and the connections between the people, all play a role in how a tweet spreads. Understanding these micro-level variables and their interactions will shed light on macro-level consequences e.g., political decisions or consumer behaviors. Our work contributes to the study of such retweet behavior on Twitter surrounding real-world events. We analyze over a million tweets pertaining to three events, present general tweet properties in such topical datasets and qualitatively analyze the properties of the retweet behavior surrounding the most tweeted/viral content pieces. Findings include a clear relationship between sparse/dense retweet patterns and the content and type of a tweet itself; suggesting the need to study content properties in link-based diffusion models.

Co-Author(s)/Collaborator(s): Meenakshi Nagarajan

TRUST in social and sensor networks

Student Presenter: Pranod Anantharam, Cory Henson

Faculty Mentor: Dr. Amit P. Sheth

Department: Computer Science & Engineering

Trust is becoming increasingly important in diverse areas such as search, e-commerce, social media, semantic sensor networks, etc. In social networks, it is important to determine whom to trust and on what topic, before making a decision. In sensor networks, the trend is towards using large numbers of cheap low quality sensors rather than a few expensive high-fidelity sensors, and relying on the middleware for aggregating, mediating, and determining trusted sensors and trustworthy sensor data. Thus, both humans and machines use some form of trust to make informed and

reliable decisions, or resolve conflicts, before acting. As agents providing critical content and services continue to become distributed and remote from the agents that consume them, and as miscreants attempt to corrupt, subvert or attack existing infrastructure, the issue of trust aggregation, propagation, inference, and update will continue to remain significant. Unfortunately, there is neither a universal notion of trust that is applicable to all domains, nor an explicit description of how one arrives at trust information in many situations, much less its automation. In this presentation, we review past work and explore future research issues relevant to trust in social/sensor networks and interactions. We advocate a balanced, iterative approach to trust that marries both theory and practice. On the theoretical side, we investigate models of trust to analyze and specify the nature of trust and trust computation. On the practical side, we propose to uncover aspects that provide a basis for trust formation and techniques to extract trust information from concrete social/sensor networks and interactions. We expect the development of formal models of trust and techniques to glean trust information from social media and sensor web to be fundamental enablers for applying semantic web technologies to trust management.

AFRL Tec^Edge Discovery Lab in Collaboration with WSU CS, EE, and WSRI

Visualization and Computing

Student Presenter: Aaron Fouts, Lance Harris

Research Mentor: Dr. Rhonda Vickery

Organization: AFRL Tec^Edge Discovery Lab in Collaboration with WSU CS, EE, and WSRI

High-performance computing (HPC) uses computer clusters and supercomputers to solve problems requiring complex computations or

many iterations of a computation with ranges of multiple parameters. Often these huge computations produce large amounts of data that must be analyzed interactively. This project investigates the challenges of programming for the HPC environment and intelligently visualizing the data. We will show our work in progress for specific challenges being investigated by the Air Force Research Lab through the Tec^Edge Discovery Lab that will require greater reliance on HPC. This project is organized and conducted at the Wright Brother's Institute Tec^Edge Discovery Lab as a collaboration of AFRL and WSU to give students an opportunity for "experiential learning" under AFRL's Academic Leadership Pipeline Scholarship (ALPS) program.

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3D Virtual Worlds and Gaming

Student Presenter: John Myers Neal Eikenberry

Research Mentor: Dr. Rhonda Vickery

Organization: AFRL Tec^Edge Discovery Lab in
Collaboration with WSU CS, EE, and WSRI

A virtual world is typically a computer-based simulated environment designed to host an online community. In this community, users can interact with one another and use and create objects. Virtual worlds are intended for its users to inhabit and interact, and the term today has become synonymous with interactive 3D virtual environments, where the users take the form of avatars visible to others graphically. This project investigates gaming technologies and virtual worlds, such as Second Life, and their application to creating virtual research spaces for student projects at Tec^Edge and to support a wide range of initiatives from innovation and collaboration, to major studies. This project is organized and conducted at the Wright Brother's Institute Tec^Edge Discovery Lab as a collaboration of AFRL and WSU to give students an opportunity for "experiential learning" under AFRL's Academic Leadership Pipeline Scholarship (ALPS) program.

Micro-air Vehicles, Robotics, and Sensor Tracking

Student Presenter: Kathleen Timmerman

Research/Faculty Mentors: Dr. John Vickery,
Dr. Rob Williams Civ USAF AFRL/RYA, & Dr.
Mateen Rizki

Organization: AFRL Tec^Edge Discovery Lab in
Collaboration with WSU CS, EE, and WSRI

Micro-air vehicles (or MAVs) are becoming an increasingly important technology with promising applications in defense, security, and commercial areas. A team of undergraduate students in engineering and computer science is developing a prototype MAV to demonstrate the detection and tracking of interesting

moving objects, some of which may be ground based lego robots. The team has been developing a prototype MAV around a quadrotor design to which sensors, communications, controls, and special software will be developed and integrated. The MAV and ground based robots will also communicate with a centralized artificially intelligent (AI) process that gathers information from all moving and stationary sensors, makes decisions, and deploys moving sensor platforms as needed. This project is organized and conducted at the Wright Brother's Institute Tec^Edge Discovery Lab as a collaboration of AFRL and WSU to give students an opportunity for "experiential learning" under AFRL's Academic Leadership Pipeline Scholarship (ALPS) program.

Earth and Environmental Science

Carbon Isotope biogeochemistry of Crystal lake

Student Presenter: Akshaya Kumar Devendra

Faculty Mentor: Dr. Songlin Cheng

Department: Earth and Environmental Science

The element carbon has two stable isotopes in nature, ^{12}C and ^{13}C . Because of mass differences of isotopes, the physicochemical properties of isotopes of an element are not identical and cause isotope fractionation in nature. Photosynthesis is one such process where the lighter $^{12}\text{CO}_2$ is preferentially assimilated into the plant tissue. Photosynthetic pathways are the primary factors that fractionate carbon isotopes. The environmental conditions, such as temperature and pH, nutrient availability, the concentration of DIC (dissolved inorganic carbon) also influence the extent of carbon isotope fractionation during photosynthesis. In aqueous environments, the carbon isotope composition of DIC reflects the nutrient

availability in water as more nutrient would enhance more preferential uptake of $^{12}\text{CO}_2$ during photosynthesis. The preferential uptake of the light carbon isotope during photosynthesis would enrich the heavier carbon isotope in the residual DIC. However, even with the same environmental conditions and nutrient availability, each phytoplankton group may fractionate carbon isotope differently. To quantify the relationship between nutrient availability and carbon isotope composition of DIC of the residual water, one needs to know the carbon isotope fractionation factors of the various members of the algal community predominate at different parts of the year. The objectives of this project are to study seasonal variation of carbon isotopes in DIC, its relationship to nutrient concentration, water chemistry, and the seasonal succession of algal community. The main lake of Crystal Lakes will be the study site it is located in Medway, Clark County, Ohio. The surface area of this region is about 0.044 Km^2 and the maximum depth about 11.9 m. The sampling is done throughout the year starting April until December. The samples collected will be used for major water chemistry, for carbon isotope analysis and for identifying the algal communities.

Sulfur cycling in a eutrophic lake

Student Presenter: Stephen Edward Sadurski

Faculty Mentor: Dr. Songlin Cheng

Department: Earth and Environmental Science

Sulfur cycling in lakes is affected by factors both without and within the water column. Precipitation and deposition of sulfur compounds, primarily from the burning of fossil fuels, depends upon location, but the changes that can occur in the lake itself can also be attributed to chemical and biological composition. Crystal Lake, in Clark County Ohio, is unique both biologically and

chemically. This project focused on the changes in hydrogen sulfide and sulfate over one year, and the relationship with the present chemoautotrophic bacteria. In this lake, anoxygenic photosynthetic purple sulfur bacteria have greatly influenced the concentrations of sulfur compounds at certain depths. These and other microorganisms use the chemical constituents in the water column as well as sunlight and carbon dioxide to make biomass. Specifically, purple sulfur bacteria take up hydrogen sulfide, and then oxidize it to elemental sulfur which is then stored within their cell membrane as globules. The elemental sulfur globules are then oxidized to sulfuric acid. These chemical processes provide energy for the microbes during periods of darkness or low sunlight. In Crystal Lake the purple sulfur bacteria tend to live at certain depths where the combination of sufficient light and anoxic conditions allows for their proliferation. Over time the changes in the inputs of sulfur from deposition and precipitation have decreased due to the enforcement of laws like the "Clean Air Act". This project, combined with past data and future studies would give valuable information about the impact of pollution control legislation on water quality in lakes.

Co-Author(s)/Collaborator(s): William Ehresman

Iron Limitation in a Eutrophic Lake

Student Presenter: William Ehresman

Faculty Mentor: Dr. Songlin Cheng

Department: Earth and Environmental Science

Microorganisms need a combination of nutrients and trace metals in order for primary production to occur. The iron (Fe) hypothesis proposed that Fe is a limiting nutrient in the Pacific and Southern Oceans, and since the nutrients required by marine and freshwater microbes are the same, then Fe maybe a limiting nutrient in freshwater systems. Past

research in freshwater systems has focused on phosphorous (P) and nitrogen (N) limitation. Recent studies done in Lake Erie, have suggested that it maybe a colimitation of P, N, and/or Fe that limits microbial activity. Nutrients and chlorophyll concentration were collected at Crystal Lake in Clark Count, OH in order to determine nutrient limitation throughout 2009-2010. Upcoming incubation experiments in spring 2010 will be conducted to determine the limiting nutrient or nutrients for the chlorophyll maximum that occurs at a depth of six to seven meters. Examination of the N, P, and Fe nutrients profiles at the lake have shown decreases in nutrient concentrations near the maximum chlorophyll concentration for the months of May, June, and August 2009.

GEOTRACES 2009 Intercalibration: Low-Level Determination of Monomethylmercury in Seawater

Student Presenter: Katlin Bowman

Faculty Mentor: Dr. Chad Hammerschmidt

Department: Earth and Environmental Science

Monomethylmercury (MMHg) is the form of Hg that accumulates in biota and poses the greatest health risk to humans. However, concentrations of MMHg in seawater are often either near or less than limits of detection with contemporary methods and instrumentation (about 50 fM), which has resulted in a paucity of knowledge regarding the oceanic distribution and cycling of this toxic compound. We have developed a new method, employing a derivatization/purge-and-trap technique, that has lowered the detection limit for MMHg to ~2 fM in seawater and thereby permits accurate quantification of both MMHg and dimethylmercury (DMHg) at trace levels. The method was used to conduct shipboard analyses of alkylmercury species during the 2009 GEOTRACES Intercalibration cruise in the

North Pacific to provide the first high-resolution, full-depth profile in a major ocean basin. Dissolved ($< 0.2 \mu\text{m}$ filtered) MMHg is low in the mixed layer ($\sim 20 \text{ fM}$), increased markedly in oxic North Pacific Intermediate Water (NPIW, 45 fM) and the oxygen minimum (1000 m , 95 fM), and uniformly low at depths below the thermocline ($27\text{--}31 \text{ fM}$). DMHg has a comparable vertical distribution, with marked increases in both NPIW and the oxygen minimum, although levels were $\sim 2\text{--}4\times$ less than MMHg. The vertical distribution of alkylmercury species in the ocean suggests that both MMHg and DMHg are produced in low-oxygen waters of the thermocline and, surprisingly, under oxic conditions in NPIW. Moreover, the uniform distribution and low concentrations of MMHg in deep water exclude deep-sea sediment and hydrothermal processes as substantial sources to the mixed layer and associated biota.

Evaluation of Water Resources in the Mbirikani Group Ranch, Loitokitok District, Kenya

Student Presenter: Katlin Bowman

Faculty Mentor: Dr. Chad Hammerschmidt

Department: Earth and Environmental Science

Access to safe water is essential for the promotion of human health. In 2007, the World Health Organization estimated that approximately one tenth of the global disease burden was attributable to unsafe water, sanitation, and hygiene practices (1). In Kenya, water is scarce: only 2% of the surface area is covered by water and 80% of the country lies in an arid climate zone (2). Changing climate conditions have increased water scarcity and led to overlapping water usage contributing to disease spread and resulting in a declining health status. Though many regions in Kenya have private and government public health institutions, their primary focus is controlling

pressing disease outbreaks such as malaria and HIV. Most organizations lack the funding and resources to conduct studies that evaluate community health. During the summer of 2009 a baseline public health survey was conducted by the School for Field Studies in the Mbirikani Group Ranch of southern Kenya. Information on demographics, water, sanitation, nutrition, health and agriculture was collected from 153 randomly selected households. Data was analyzed using statistical software and results along with recommendations for improvement were presented to local community members and government health officials. The Kimana pipeline was identified as the primary drinking water source in the Mbirikani Group Ranch. This water source, along with others, was also used for domestic practices, livestock (including pesticide application) and agriculture. A high risk for enteric illness was associated with unprotected water sources, suggesting that this shared usage is a threat to human health. A majority of households do not treat their water because they believe that it is safe to drink. This is largely influenced by the misconception that water coming from a pipe is treated while the Kimana pipeline is only treated at the source.

Electrical Engineering

FMCW Radar Ranging Device

Student Presenter: Adrian Bayraktaroglu, Thang Tran, Jason Quillen

Faculty Mentor: Dr. Lang Hong

Department: Electrical Engineering

Research and develop a low-cost range and velocity measuring device using Frequency Modulated Continuous Wave (FMCW) radar, utilizing the potential of the affordable IVS-162 transceiver. The IVS-162 transceiver is capable of detecting objects in the approximate range of 3 – 25 meters. Through our engineering we will present that it is possible to achieve high

resolution within a 10 meter range using the IVS-162. Data acquisition was captured utilizing a variety of stationary and moving targets at differing ranges and velocities. In order to process the return signal data more effectively and to create a higher resolution, a Butterworth band-pass filter was designed to create a more desirable signal to noise ratio while simultaneously providing signal amplification. Signal to noise ratio optimization was accomplished by interfacing the transceiver with a 6th order active high-pass filter cascaded with a 2nd order active low-pass filter with cut-off frequencies located at 7.5kHz and 40kHz respectively, providing approximately 17dB of amplification. Additionally, a high accuracy low noise triangular waveform generator was developed with a pulse repetition frequency of 750Hz, a DC offset of 2 volts, and a 4 volt peak-to-peak swing. Furthermore, with the design specifications of the triangular waveform and Butterworth filter realized we were able to accurately determine both the range and velocity of targets within a 6-17 meter range. Signal processing was accomplished offline by sampling our data with an analog to digital converter (ADC), with a sampling frequency of 150 kHz, then importing the raw data to MATLAB. Fast Fourier Transform (FFT) algorithms were designed to capture the data from the rising and falling edges of the filtered triangular waveform to accurately determine both the range and velocity of multiple objects.

RCAD: Bicycle Radar

Student Presenter: April Johnson, Cara Rupp, Brad Wolf

Faculty Mentor: Dr. Lang Hong

Department: Electrical Engineering

The objective of this project is to detect moving objects and provide useful information to a bicycle rider by designing and implementing a

"Bicycle Radar System". The resulting device will be compatible with the iPod Touch and iPhone displays. This system will be able to detect moving objects between a 2 and 50 meter range. The application will give the bicyclist the ability to change the range depending on how densely populated the area he or she is intending to bike. There will be two common modes: one for biking on main roads (densely populated, fast objects), and a mode for biking on trails (less dense, slower objects). The iPod Touch will display the range and velocity information of the objects from the radar overlaid on live video in a user-friendly manner on the screen. The application will produce an audible sound if the user is listening to music, and a visual alert when objects are within certain "caution" and "danger" ranges which will depend on the mode chosen.

WrightBot Intelligent Robotic Lawnmower

Student Presenter: Randy Depoy, Robert Nicolato, Joseph Esperanza

Faculty Mentor: Dr. Kuldip Rattan

Department: Electrical Engineering

The 7th Annual ION Robotic Competition is an annual competition in which top universities vie to be for the best automated lawnmower. The specifications for the WrightBot's design are dictated by the competition. In the midst of competition, the WrightBot will need to avoid both static and dynamic obstacles, while maneuvering and mowing a field. Sensors must be coordinated to efficiently analyze and avoid obstacles. Sensor design for the WrightBot includes: a dual differential global positioning system (GPS), a laser range finder, a force sensing bumper, and an electro-optic (EO) camera. All of these sensors are coordinated with the aid of a computer program. The dual differential GPS allows the WrightBot to determine its direction along with its current global position down to an accuracy of several

centimeters. The laser range finder determines the WrightBot's current distance from an obstacle. To avoid static and dynamic obstacles, it is integral to measure distances. The force sensing bumpers incorporate a unique design of a microcontroller and linear potentiometers. This design determines an initial value of the reference voltage from the linear potentiometers and compares it to the current value of the linear potentiometers. This comparison along with a corresponding distance computation is performed by the microcontroller. This is useful when the laser range finder is no longer detecting an object, and the WrightBot is slowly approaching a static obstacle. The EO camera complements the laser range finder operation. With this dual system, the WrightBot is able to detect an object in the grass with the laser range finder and then compare the color spectrum of that object with a flower bed's black edge. Incorporating all of these sensors into an intelligent autonomous lawnmower will pay off during competition.

Video Tracking System

Student Presenter: Sarah Bischoff, Holly Zelnio, Trinh Do

Faculty Mentor: Dr. Brian Rigling and Dr. Juan Vasquez

Department: Electrical Engineering

We propose to assemble a portable video tracking system requiring only a camera, GPS unit, and a laptop. The benefits of our proposed tracking system include reliable geo-space tracking, rapid set-up time, portability, and the use of a novel feature-aided tracking algorithm. In the past UAV's have played an essential role in video tracking, which is undesirable for smaller tracking applications. In our system, a mounted, stationary ground camera will eliminate the higher cost and weather constraints of a UAV. Other

comparable video tracking systems perform tracking in pixel-space. Our system will perform tracking in geo-space, which will yield more accurate results. Such a system would be highly desirable for defense work and home and business security. Our expected primary consumers are private companies and government.

Wireless Power

Student Presenter: Scott Metzger, Mikiyas Barkneh Myhuong, Vo Angela West

Faculty Mentor: Dr. Yan Zhuang

Department: Electrical Engineering

This project involves the rectification of wirelessly transmitted power and the modeling of coupling coils using HFSS. Rectified power is essential to modern electronic devices. Applications of this technique are essential in the process of charging batteries. Traditional methods of charging batteries make use of a tethered system in which the item being charged is physically attached to the charger. Past experiments with the transmission of wireless power have been carried out by famous engineers such as Nikola Tesla and institutions such as M.I.T. These experiments used the transmitted high frequency power directly in applications such as powering light bulbs. By rectifying this transmitted power, mobile consumer devices can be charged without the hassle of trying to find an electrical outlet to use. There are devices currently for sale that allow the wireless charging of mobile electronics, but their range is extremely limited. Through the use of HFSS and an efficient rectifier design we will improve this range. Through the use of commercially available parts the total budget can be kept to a minimum. Currently this project has realized some transmission of power. With the addition of matching networks and a power amplifier, approximately 750 mW of power can be

delivered from the transmission coil to the receiver coil. 750 mW is an adequate amount of power for battery chargers, mobile electronics and devices such as super capacitors. Once completed this system will free consumers from being tethered to a wall outlet and allow their devices to operate at peak capacity while being continually charged.

Electrical Engineering and Hexagon Metrology

PWM3.24 Power Amplifier for CMM's

Student Presenter: Erik deAlmeida Marcos, Aranha Suchit Patel

Faculty Mentor: Mr. Bob Brandstetter and Dr. Marian Kazimierczuk

Department: Electrical Engineering and Hexagon Metrology

Engineering companies, as any other companies, have been facing tough times due to the economic decay. In order to compensate for the loss of market and increase the chances of overcoming this economic recession, companies have been looking for less expensive alternatives that will hold or improve the cost-benefit of a process or product. Thus, Hexagon Metrology Incorporated, a multinational metrology company, is looking for an alternate power amplifier to replace the module currently in use that will decrease cost without affecting performance. The power amplifier is used to drive their small Coordinate Measurement Machine (CMM). The team intends to modify a Pulse Width Modulation (PWM) power amplifier, originally designed by DEA, an Italian subdivision of Hexagon Metrology, and integrate it into the Hexagon CMM controller, UMP-360. The amplifier must replicate the inputs and outputs (I/O's), performance, and efficiency of the current power amplifier module. In order to validate

the success of the design, a battery of tests and MATLAB simulations will be performed, using the original power amplifier and the new power amplifier. The results will be gathered and analyzed to show comparisons. The criterion for success is to demonstrate identical performance between the power amplifiers, to an acceptable margin of error.

Emergency Medicine and Neuroscience, Cell Biology and Physiology

Localization of fluorescent probes in rat brain tissue stained with hematoxylin: a methodology development study

Student Presenter: Ahmed Obeidat

Faculty Mentor: Dr. James Olson

Department: Emergency Medicine and Neuroscience, Cell Biology and Physiology

Biocompatible probes can be promising diagnostic and drug targeting molecules; however the ability to localize them in their target organs maybe difficult. In this study, hematoxylin stained and unstained paraformaldehyde-fixed brain tissue sections harvested from adult rats injected with fluorescent probes (FP)—[Excitation 450-580 nm, emission 630-670 nm] and uninjected vehicle control rats were examined using epifluorescence microscopy [Excitation 545-580 nm, emission cutoff 610 nm]. Unstained brain sections from control and FP-injected rats showed significant tissue auto-fluorescence which could interfere with visualization of fluorescent probes in brain sections. We observed that tissue stained with hematoxylin had significantly reduced auto-fluorescence both in control and FP-injected rats while the fluorescence of FPs in injected animals was not noticeably different in stained versus unstained sections. The visible absorbance spectrum for hematoxylin in solution has a broad peak

centered at 557 nm and thus would not interfere with the FP fluorescence emission. We conclude that brain tissue stained with hematoxylin specifically quenches tissue auto-fluorescence while sparing the fluorescence signals from the fluorescent probes

Co-Author(s)/Collaborator(s): Robert Spokane, Michael Kent

Regulation of the Neuronal Taurine Transporter Protein

Student Presenter: Amanda Freeman

Faculty Mentor: Dr. James E. Olson

Department: Emergency Medicine and Neuroscience, Cell Biology, and Physiology

Cytotoxic brain edema occurs in a variety of pathological conditions. Net efflux of the amino acid taurine from neurons contributes to neuronal volume regulation during brain edema. Taurine is accumulated in both neurons and glial cells by a specific 72-75 kDa membrane transporter, TauT. Neuronal and glial forms of TauT are similar in structure; however, functional TauT activity decreases in swollen neurons, but is not altered in swollen astroglial cells. In contrast, activation of protein kinase-C (PKC) has no effect on neuronal TauT activity, but causes protein phosphorylation and inhibits the transporter in astroglial cells. Thus, we hypothesize that regulation of neuronal and glial TauT is mediated by different signaling mechanisms. Methods: Primary neuronal cultures from rat hippocampus were incubated under isoosmotic or hypoosmotic conditions. After 30 min we measured total and sub-cellular TauT expression using cell fractionation and western blot analysis. Results: In control neurons, TauT appeared as a 97 kDa peptide in cytosolic and membrane/particulate fractions. However, in neuronal cultures treated with hypoosmotic medium the density of the TauT band was significantly reduced in the cytosolic and membrane/particulate

fractions while a prominent 74 kDa band appeared in the nuclear fraction. Total TauT expression was not altered by hypoosmotic exposure. Conclusion: TauT in normal cultured hippocampal neurons may be substantially glycosylated or closely associated with other peptides while in the plasma membrane. The apparent molecular weight of TauT is reduced in swollen neurons while it is redistributed from the cell membrane to the nucleus. Internalization of the transporter from the plasma membrane may account for the reduction in functional TauT transport activity observed in swollen neurons and may contribute to neuronal volume regulation.

English Language and Literature

Someday My Prince Will Come: A Look at the Impact of Fairy Tales on Children

Student Presenter: Holly Jackson

Faculty Mentor: Sarah McGinley

Department: English Language and Literature

Fairy tales are available in a wide variety of media...from the original tales themselves, often from the Grimm brothers, Charles Perrault, or Giambattista Basile to Disney movies and all of the franchising associated with Disney. Despite being widely available, little research has really been done when it comes to the impact that fairy tales can have in a person's life. Fairy tales like Cinderella and Sleeping Beauty seemingly approve of women being weak, submissive, and incredibly dependent on their princes. Without 'Prince Charming,' Cinderella would have still been under her stepmother's thumb and Sleeping Beauty would still be under a sleeping spell. Similar situations can be seen in other tales, such as Snow White, Rapunzel, The Little Mermaid, and even Thumbelina. The central female character in a fairy tale typically is, or will become, a princess at some point in time,

at least in the more popular tales. These girls require their princes in order to live a more complete and trouble-free life. Children who watch the Disney versions of fairy tales, or perhaps read the original versions, see or read these stereotyped personas and will pretend to be like the characters, whether the character is the prince, princess, villain(ess), or just a side character. Throughout the rest of their childhood and their lives, these children will recall the stories and movies, and the play and characteristics of their favorite characters could incorporate themselves into the person's life, sometimes leading to more serious psychological issues. The fact of the matter is that fairy tales stick in children's minds and can seriously impact children's lives as they grow to adulthood, often in a negative way.

Maintaining and Promoting Literacy at the Secondary Level

Student Presenter: Elisabeth Cary

Faculty Mentor: Nancy Mack

As Jim Trelease writes in his book, *The New Read-Aloud Handbook*, "The desire to read is not born in a child. It is planted..." (39). Many English teachers view this planting the desire to read in their students as integral to their success as teachers. Holistic literacy, that is, the ability to learn independently, is founded upon reading and comprehension. In the classroom, there are numerous ways to produce a love of learning. Three specific practices that are used successfully are sustained silent reading (SSR), summer reading, and reading aloud. Sustained silent reading, while having a good result among most teachers and schools who implement this practice, seems to need more structure than many suggest. Summer reading is an old practice that has been effective in helping students maintain literacy over the months when they are not in classes, but has also become less effective due to difficulty in

accessing books. Reading aloud seems like an odd option for teachers to utilize, but through teaching students listening skills as a way to comprehend books, teachers may demonstrate how such skills may be carried over into reading a text independently. This essay discusses each of these strategies, addresses deficiencies that may inhibit usefulness, and gives suggestions for remedying these potential failures. A lesson plan and summer reading assignment are also provided as appendix material.

Trelease, Jim. *The New Read-Aloud Handbook*. New York: Penguin Books, 1989.

History

Tragedy in Fall River

Student Presenter: Stephen Rumbaugh

Faculty Mentor: Mary Anne Kirk

Department: History

Tragedy in Fall River is an 8-minute documentary produced for HST-717 Multimedia in Public History in Winter 2010 quarter. This brief video summarizes the events preceding the murders of Andrew and Abby Borden on the morning of August 4, 1892 in their home in Fall River, Massachusetts. Accused of the crimes was Andrew's daughter, Lizzie, who subsequently became one of the most infamous characters in the history of American crime and popular culture. Tragedy tells the tale of Lizzie Borden through narration, photographs, and newspaper clippings, researched and edited to concisely present the details leading up to and immediately following the most sensational trial of the nineteenth century.

Information Systems and Operation Management

Trial, adoption and continued usage of new media

Student Presenter: Akshay Mahesh Jain

Faculty Mentor: Dr Anand Jeyaraj

Department: Information Systems and Operation Management

Our objective is to understand and analyze the behavior of individuals on their trial, adoption and continued usage of new media. New media is a term meant to encompass the emergence of digital, computerized, or networked information and communication technologies in the later part of the 21st century. The various examples for the same are blogs, personal websites, social networking sites, games, podcasts and video sharing sites. The trial usage concerns with the reasons associated for the first time use by individuals, the adoption usage concerns with the reasons for their motivation to use it further, and continued usage concerns with the reasons for their continued usage till today. The different factors which might influence an individual for trial, adoption and continued usage of new media were identified as follows: Technology factors- Ease of use, Features of technology; Individual factors- Entertainment, information and communication purposes; Social factors- Peer pressure. Data collection: Interviews were conducted by data collection agency wherein a set of questions that were framed were asked to respondents (n=80). Data analysis: (1) Quantitative data analysis is used for analyzing such large amount of data. (2) Here, a general coding sheet was prepared to record the responses of an individual corresponding to each technology, (3) Similar patterns are to be detected from coding sheet and then statistical analysis would be performed. Based on our preliminary findings, it seems like it is because of social factors people are into trial, adoption

and continued usage of new media. Further, research has to be carried out to confirm our preliminary findings.

Mathematics and Statistics

Block Weighing Matrices

Student Presenter: Edmund Velten

Faculty Mentor: Dr. K. T. Arasu

Department: Mathematics and Statistics

Block weighing matrices are weighing matrices whose block elements are zeros or elements of orthogonal projectors. We discuss two classes of these matrices, one of a Hankel design, having constant antidiagonal blocks, and one of an anticirculant design, whose i^{th} and $i+n^{\text{th}}$ block antidiagonals are equivalent.

A Survey of Group Weighing Matrices

Student Presenter: Jeff Hollon

Faculty Mentor: Dr. K. T. Arasu

Department: Mathematics and Statistics

A weighing matrix is a square $(n \times n)$ matrix whose entries are in the set $\{1, 0, -1\}$ and also satisfies the property that the matrix times its transpose is a positive integer multiple times the identity matrix. That is to say: $W W^t = k I$. The value of k is called the weight of the matrix W and its size n is the order. A group weighing matrix is a weighing matrix which is acted upon by some group. This refers to the placement of the entries w_{ij} throughout the matrix. By setting the elements in the first row the group (acting on the matrix) will fill the remaining entries by the formula $w_{ij} = g_i g_{j-1}$. In this talk we are speaking only of abelian groups. The interest of these structures is whether or not they exist for a given order and weight. We will present properties and known results for the

existence of group weighing matrices with orders and weights less than 100.

On Multilevel Hadamard Matrices and their construction

Student Presenter: Keli Parker

Faculty Mentor: Dr. K.T. Arasu

Department: Mathematics and Statistics

The existence of Multilevel Hadamard matrices (MHMs) of all orders as well as a construction for full-rate circulant MHMs of all orders $n \neq 4$ is known. We use computer search methods to look for previously unknown full-rate circulant MHMs of orders 5, 6, and 7 and find solutions that potentially do not follow from the known construction. We then give an alternate construction to explain some order six MHMs.

On construction of a family of $[22t, 3t+1, 22t-1-2t-1]$ binary linear codes

Student Presenter: Shirin Badiei

Faculty Mentor: Dr. Xiaoyu Liu

Department: Mathematics and Statistics

We searched within homogeneous quadratic bent functions in four variables and within homogeneous cubic and homogeneous quadratic bent functions in six variables for 2-dimensional and 3-dimensional subspaces of bent functions, respectively. Using the t -dim bent function subspaces, we constructed binary linear codes of parameters $[22t, 3t+1, 22t-1-2t-1]$ from cosets of the first-order Reed-Muller code of length $22t$ for $t=2, 3$.

Motion Pictures

The First Desire To Castration A Psychoanalysis Look At Requiem For A Dream

Student Presenter: Jay Taylor

Faculty Mentor: Nicole Richter

Department: Motion Pictures

Abstract : In the 1978 novel Requiem For A Dream, Hubert Selby writes about the American Dream and how it never becomes more than such for his characters. In 2000, Darren Aronofsky and Selby adapted the novel for the big screen. Aronofsky's film is a unique combination of high style and unflinching drama. Aronofsky's use of style reinforces his Marxist film techniques, which help reveal a gritty truth about addiction, beyond just "drugs." The film brings into question, what is addiction? And what drives us toward it? Using psychoanalysis, beginning with Freud, reissued by Lacan, and translated by Slavoj Žižek, I navigate the film's narrative plot as a reflection of the human condition commandeered by the Death Drive. The Death Drive is not to be confused as a death wish, but a wish for life of excess. Each character in Requiem For A Dream desires to remake their identity through vertical social mobility. Their desire, and path can be traced within Harold Bloom's uniquely American Sublime. Compelled by the American Myth, executed through the American Sublime, and dammed by the Death Drive, I am able to categorize the character's desires into psychoanalytic understanding of: Jouissance, objet petit a, and Fetishtic Disavowel. This paper uses psychoanalysis to analyze several scenes, which can be seen as reenactments of key ideas in psychoanalytic discourse.

Neuroscience, Cell Biology and Physiology

Glial Cell Development in the Spinal Cord from Ventricular Zone p1 Progenitors and V1 Cellular Precursors

Student Presenter: Travis Rotterman

Faculty Mentor: Dr. Francisco J. Alvarez

Department: Neuroscience, Cell Biology and Physiology

The neural tube contains five classes of ventral neural progenitor domains (p0, p1, p2, pMN, and p3) which are induced at different locations in the neural tube based on the dorso-ventral gradient concentrations of Sonic Hedgehog and Bone Morphogenetic proteins (1). Each progenitor domain generates different types of ventral neurons of the spinal cord, including the motoneurons. The origins of glial cells are, however, not well established. It is thought that the majority of oligodendrocytes are derived from the motoneuron progenitor domain (pMN). In contrast, astrocytes are thought to derive from precursors of dorsal horn cells. Previous studies have shown that a small percent of oligodendrocytes and astrocytes can be derived by cells that express the transcription factor Dbx (2). This transcription factor is also found in the ventral p1 domain and their cellular derivatives. The p1 domain produces V1 inhibitory interneurons, and these particular cells express a transcription factor known as Engrailed-1 (En1) when they become post-mitotic. This project proposes that some glial cells may also be derived from V1 precursors and therefore p1 progenitors. To test this hypothesis, we used transgenic mice in which the cellular lineage of V1 engrailed-1 expressing cells was labeled genetically with various reporter genes (mostly LacZ). In spinal cord sections from these animals we then analyzed with immunocytochemistry the expression in V1 cells of markers of oligodendrocytes or astrocytes at various stages of maturation. The results show that some spinal cord glial cells are in fact derived

from V1 cells. Future experiments will determine the mechanism that switches the cellular fates of V1 cells from neural to glial.

Calbindin D-28k is a dendritic marker in MNTB principal cells

Student Presenter: Adam Deardorff

Faculty Mentor: Dr. Robert E.W. Fyffe

Department: Neuroscience, Cell Biology and Physiology

The Medial Nucleus of the Trapezoid Body (MNTB) has received considerable attention in the discipline of synaptic physiology. For decades the direct examination of mammalian synapses in the CNS had been precluded by the small size and widespread distribution of synaptic terminals. However, the round morphology of the MNTB principal cell and the large size of its primary synaptic input, the glutamatergic calyx of Held, has recently allowed researchers to obtain simultaneous pre- and postsynaptic recordings without the electronic complications of dendritic filtering. However, the precise role of principal cell dendrites has yet to be defined and, the presence of significant functional dendritic inputs has become a contentious issue. Dendrites comprise up to 25% of the principal cell surface area, adding considerable capacitance to the neuron and creating tremendous potential to affect postsynaptic firing capabilities. While recent physiological data indicating active dendritic Na⁺ and K⁺ conductances may contribute to the faithful propagation of high frequency synaptic input suggests that principal cell dendrites not be so readily ignored, a reliable and effective immunohistochemical marker for them has yet to be identified and critical data regarding dendritic channel distribution and synaptic contacts yet to be obtained. This poster concerns preliminary observations using a method for direct immunohistochemical

observations of MNTB principal cell dendrites. The objectives are to: 1) determine the expression of CB-D28k in the MNTB of normal hearing and congenitally deaf mice, 2) identify principal cell dendrites labeled by antibodies directed against CB-D28k, and 3) identify putative synaptic contacts and voltage gated potassium channels on principal cell dendrites.

Expression of Kv3.1b in the MNTB of normal hearing an congenitally deaf mice

Student Presenter: Adam Deardorff

Faculty Mentor: Dr. Robert E.W. Fyffe

Department: Neuroscience, Cell Biology and Physiology

The medial nucleus of the trapezoid body (MNTB) is a key brainstem relay nucleus involved in sound localization. The primary excitatory input to MNTB principal cells is formed by specialized Calyx of Held synapses, arising from axons of globular bushy cells of the of the contralateral anteroventral cochlear nucleus (AVCN). Neurons in the MNTB are topographically organized according to a tonotopic map present throughout the auditory system. Cells responding best to high frequency stimulation are located medially within the nucleus, while cells responding best to low frequency stimulation are located laterally. A variety of mechanisms underlies MNTB synaptic response properties and discharge capabilities in accordance with the tonotopic map. One such mechanism is likely to be rapidly activating K⁺ currents. The functions of channels containing Kv3.1 subunits have been extensively characterized throughout the central nervous system. Within the MNTB, they contribute to a rapid high voltage activating K⁺ current that repolarizes action potentials (APs), facilitates high frequency firing, and aids in the faithful propagation of synaptic inputs. Further, tonotopically organized expression gradients of Kv3.1b have been demonstrated in

several auditory brainstem nuclei including the rat MNTB, the avian nucleus mangocellularis, and mouse spiral ganglion. That these studies show stronger Kv3.1b expression in portions of the nucleus containing neurons with high characteristic frequency (CF), suggests such expression may correspond with other specializations in higher CF neurons allowing more rapid APs and higher transmission rates. The aim of this study is to determine 1) the distribution of Kv3.1b within the MNTB of normal hearing mice and 2) using a congenitally deaf (dn/dn) mouse model that lacks auditory nerve activity throughout development, if altered neural activity causes changes in the level and or pattern of Kv3.1b expression within the MNTB.

Structural and Immunohistochemical Studies of CO₂-sensitive Brainstem Neurons

Student Presenter: Cathy Graham

Faculty Mentor: Dr. Robert W. Putnam

Department: Neuroscience, Cell Biology and Physiology

We identified CO₂/H⁺ sensitive and insensitive neurons in rat locus coeruleus (LC) using whole cell patch clamp techniques. The firing rate was recorded in individual neurons in brainstem slices in aCSF equilibrated with 5% CO₂. Neurons whose firing rate increased >20% in response to 15% CO₂ were identified as chemosensitive. Neurons were loaded with Lucifer Yellow, imaged using confocal microscopy, and reconstructed in NeuroLucida. The soma of chemosensitive neurons were fusiform with an average aspect ratio of 3.14 while the soma of nonchemosensitive neurons were multipolar with an aspect ratio of 1.4. The primary dendrites on chemosensitive neurons were of small diameter (mean 2.3±1.0 μm) while those on nonchemosensitive neurons were larger in diameter (4.4±1.3 μm). The dendritic field surface area of chemosensitive

neurons was 3191 μm^2 , with a volume of 1112 μm^3 , while in nonchemosensitive neurons the dendritic surface area was 3751 μm^2 and volume was 2153 μm^3 . The dendrites of chemosensitive neurons were longer than those of nonchemosensitive neurons, terminating near the surface of the slice for chemosensitive neurons. These structural findings have implications for the region of the neuron responsible for chemosensitive signaling and will be used in the development of mathematical models. The response of chemosensitive neurons is largely dependent on pH-sensitive K^+ channels, which are inhibited by acidification of the extracellular environment. We used immunohistochemical methods to reveal the regional and cellular distribution of the voltage gated potassium channel subunit, Kv1.4. This subunit was distributed throughout the brainstem but heavy labeling was observed in the LC. Kv1.4 subunits were localized to the soma and proximal dendrites. Not all LC neurons labeled heavily for Kv1.4. Our findings will complement electrophysiological studies aimed at identifying the K^+ channel subunits responsible for CO_2 -responsiveness in chemosensitive neurons.

Nanotechnology Applications to Biodefense Research

Student Presenter: John Trefry

Faculty Mentor: Dr. Dawn P. Wooley

Department: Neuroscience, Cell Biology and Physiology

The bioterrorism attacks perpetrated after 9/11 have forced a change in biological research across the nation. The Department of Health and Human Services and The Department of Homeland Security have both called for immediate research on the development of countermeasures for biological weapons. Nanotechnology offers unique and far-reaching

solutions to the needs of bio-threat elimination. Our research is based on the application of silver nanoparticles (AgNPs) as broad spectrum anti-viral as well as anti-bacterial agents. As viral countermeasures we have successfully demonstrated that AgNPs are capable of preventing the entry of a smallpox analog virus. To accomplish this task an FDA viral neutralization assay was modified to work during the viral entry time frame. The results show that AgNPs significantly prevent poxvirus entry at amounts as low as 63 $\mu\text{g}/\text{mL}$. Furthermore, AgNPs prevented the infection of the human immunodeficiency virus (HIV) bioengineered to express an entry factor that allows it to infect almost any cell in the human body, instead of its normal T-cell target. To determine AgNP effectiveness against HIV, a novel antiviral assay was created. Our novel assay shows AgNP inhibition of HIV as low as 2 $\mu\text{g}/\text{mL}$. The Wooley laboratory has also shown AgNPs have potent antibacterial properties against *Staphylococcus aureus*, *Escherichia coli*, and *Yersinia pestis*, the causative agent of plague. Using standard antimicrobial and drug development techniques, an effective antibacterial concentration was determined to be 17.5 $\mu\text{g}/\text{mL}$. AgNP toxicity testing has shown our standard 25 nm AgNPs to be non-toxic at concentrations as high as 1,000 $\mu\text{g}/\text{mL}$. The large gap between the effective antimicrobial and cytotoxic concentrations shows that AgNPs have the potential for a high therapeutic index. This suggests that AgNPs could be used as a broad-spectrum antimicrobial agent to protect the population from any sort of biological catastrophe, natural and man-made.

Co-Author(s)/Collaborator(s):Rupert C. McRae

The Role of Calcium in Central Respiratory Control Neurons

Student Presenter: Ann Imber

Faculty Mentor: Dr. Robert W. Putnam

Department: Neuroscience, Cell Biology and Physiology

The cellular pathways that underlie central respiratory control have been implicated in several respiratory diseases including Sudden Infant Death Syndrome and sleep apnea. Central respiratory control involves neurons from several brainstem regions whose firing rate is altered in response to changes in CO₂. Most research has focused on the role of changes of pH and pH-sensitive ion channels as the basis for neuronal chemosensitive responses to CO₂. Little is known, however, about the potential role of Ca²⁺ in central chemosensitive signaling. We have evidence that high CO₂ activates L-type Ca²⁺ channels in the noradrenergic neurons of the locus coeruleus (LC), a known chemosensitive region involved in respiratory control. Our studies use electrophysiology to address the postnatal development of an L-type Ca²⁺ current in these cells that is sensitive to changes in CO₂. The presence of Ca²⁺-activated potassium channels (KCa) in conjunction with this pathway raises the possibility that activation of KCa channels by elevated intracellular Ca²⁺ may serve to limit the high CO₂-induced increased firing rate in LC neurons. The activity of these Ca²⁺ channels increases dramatically over the first two weeks of life in neonatal rats, suggesting that the chemosensitive response of LC neurons may be most prominent shortly after birth. This agrees with our studies of the developmental changes of LC responsiveness to increased CO₂ during early life. We have also studied the mechanism by which increased CO₂ activates Ca²⁺ channels. We have evidence that L-type Ca²⁺ current is activated by increased intracellular HCO₃⁻ which activates a HCO₃⁻-sensitive adenylate cyclase (sAC). This results in subsequent phosphorylation and activation of L-type calcium channels via cAMP-activated protein kinase A. Our work indicates a novel role for Ca²⁺ in controlling chemosensitive signaling. Disruption of this

pathway may lead to breathing instabilities associated with respiratory diseases. Supported by NIH Grant R01-HL56683-13.

High Efficiency Lentiviral Gene Targeting

Student Presenter: Deanne DuVal

Faculty Mentor: Dr. Thomas L. Brown

Department: Neuroscience, Cell Biology, and Physiology

Lentiviral delivery is a highly efficient means of gene transfer. It is not known, however, if simultaneous infection of more than one virus will still be efficient. We hypothesize that simultaneous infection of two lentiviral constructs will infect fertilized single cell zygotes at a high rate of efficiency. To examine this hypothesis, we will determine the rate of infection with a Lv-GFP construct, a Lv-RFP co construct, and following simultaneous infection with Lv-GFP and Lv-RFP constructs. Efficiency of infection will be determined by zygote positivity under epifluorescent microscopy. Lv-GFP is available, however pLv-RFP must be cloned. To create pLv-RFP, Lv-GFP-V5 and the plasmid Pc3-RFP will be double digested using the restriction enzymes BamHI and Apal. The back bone of the GFP plasmid and the RFP insert will then be excised, gel purified, and ligated together. The ligation will then be digested with Spe1 to disrupt any pLv-GFP that may be present. Following bacterial transformation, colonies will be selected, grown, purified, and analyzed for the correct insert. Lv-RFP will then be used to transfect 293FT cells to produce lentiviral-RFP and virus will be collected. Lentiviral RFP will then be used to determine infection efficiency in Cos7 cells and then in single celled zygotes. This project is of importance in that it will determine the efficiency level of dual infection in zygotes that will subsequently be analyzed in vivo. This elevated level of manipulation provides a higher level of gene targeting with the

capability of reducing time from start to finish from 1-2 yrs to 1-2 months. The significance of the analysis will be beneficial to numerous investigators in many disciplines for in vivo analysis of specific gene targeting events.

Dynamic Redistribution of Kv2.1 Ion Channels on Spinal Motoneurons Following Increased Neural Activity

Student Presenter: Shannon Romer

Faculty Mentor: Dr. Robert Fyffe

Department: Neuroscience, Cell Biology, and Physiology

Pathophysiological conditions such as peripheral nerve injury cause significant alterations in neuronal activity and excitability as well as changes in synaptic organization in spinal motor circuits. However, despite successful reinnervation of peripheral targets after injury, seldom the recovery of motor function is complete. The intrinsic excitability of motoneurons is controlled in part by the expression of voltage gated ion channels. Kv2.1 channels, which underlie delayed rectifier potassium currents, are localized in high density macroclusters ($>1\mu\text{m}^2$) and miniclusters ($<1\mu\text{m}^2$) on the soma and proximal dendrites at specific postsynaptic sites in spinal motoneurons (Muennich and Fyffe, 2003). Kv2.1 channel properties and membrane clustering are phosphorylation dependent (e.g. Park et al., 2006) and highly regulated by a variety of stimuli including ischemia, hypoxia, neuromodulator action and activity. Increased neuronal activity dephosphorylates Kv2.1 through Calcium-Calcineurin dependent mechanisms leading to declustering and a hyperpolarizing shift in activation of the delayed rectifier current (Misonou et al, 2004). Following peripheral nerve injury, Kv2.1 macroclusters decrease in both number and cluster area in spinal motoneurons. Therefore, we hypothesize that the Kv2.1 clustering might

be modulated by the changes in activity following peripheral nerve injury. To test this hypothesis we analyzed with confocal microscopy the surface distribution of Kv2.1 channels revealed by immunohistochemistry. The results indicate a decrease in size and number of Kv2.1 macroclusters following in vivo nerve stimulation and in vitro stimulation with glutamate and muscarine. These data suggest that an increase in motoneuron activity can cause a redistribution of Kv2.1-IR similar to the Kv2.1-IR seen following peripheral nerve injury. The dynamic regulation of Kv2.1 channels after peripheral nerve injury may be related to changes in motoneuron excitability.

Co-Author(s)/Collaborator(s):Robert Tracy

OB/GYN and Pharmacology and Toxicology

Generation of Megakaryocytes and Platelets From Human Endometrium

Student Presenter: Samantha J. Stegeman

Faculty Mentor: Dr. Lawrence Amesse and Dr. Yanfang Chen

Department: OB/GYN and Pharmacology and Toxicology

Introduction: In vitro culture systems that produce a large number of megakaryocytes (MKs) and platelets from human stem cells have the potential of revolutionizing transfusion medicine as a treatment for a variety of bleeding disorders. In previous studies, MKs and platelets were generated in vitro from hematopoietic and embryonic stem cells with some success. However, the isolation of human endometrial stromal stem/progenitor cells is a burgeoning field of investigation and the in vitro generation of MKs and platelets from these cells can lead to the treatment of heavy menstrual bleeding disorders using the patient's own stem cells. Here, we have reported a novel in vitro culture system that

generates MKs and platelets from human endometrial stromal cells (ESCs). Method: Endometrium samples were collected from a premenopausal woman undergoing a hysterectomy for uterine leiomyomata. The ESCs were isolated from the benign proliferative endometrium and cultured for 4 passages. The cells were then used for two differentiation strategies. The first strategy involved incomplete differentiation into adipocytes followed by subsequent culturing in MK differentiation buffer, which contained 50 ng/ml of thrombopoietin, for 18 days. The second strategy involved culturing the ESCs directly in the MK differentiation buffer for 18 days. Confirmation of megakaryocyte and platelet production was conducted by using immunocytochemistry staining for MK-specific markers (CD41a, CD42a, and CD42b) with propidium iodide and subsequent examination under fluorescent and confocal microscopy. Positive identification of the megakaryocytes and platelets were obtained by their morphological characteristics, size, immunophenotypic expression of the specific markers, and nuclear staining patterns. Results: After confirming the megakaryocyte and platelet production it was determined that both strategies have a similar efficacy (35±8/field and 26±6/field, n=5/group, strategy one vs. strategy two, p>0.05). Conclusion: Human ESCs can serve as a useful source for in vitro generation of megakaryocytes and platelets for potential clinical use.

Co-Author(s)/Collaborator(s):Jinju Wang

Pharmacology and Toxicology

The Effects of Chlorpyrifos on Insulin Secretion in the Pancreatic β -cell line RIN-m5f

Student Presenter: Zhongyu Yan

Faculty Mentor: Dr. David Cool

Department: Pharmacology and Toxicology

Chlorpyrifos (CPF) is a well-known organophosphate insecticide that inhibits acetylcholinesterase (AChE). Organophosphates, including chlorpyrifos (CPF), have been shown to induce hyperglycemia in both humans and animals that cannot be explained by AChE inhibition alone. Prohormone convertase (PC) 1/3 and 2 are structural closely related to AChE. If CPF is able to modify and inhibit PC enzymes as it does to AChE, the potential inhibition of PC enzymes by CPF will interrupt the conversion of proinsulin to insulin and further insulin secretion. We hypothesize that CPF impairs insulin secretion through inhibition of PC enzyme activity. We have used a pancreatic β -cell line RIN-m5f (RIN) as a model to study the effects of CPF on insulin secretion. Our results showed that RIN cells treated with CPF for 4 hr exhibited dose-dependent decreases in insulin secretion in response to 50 mM potassium (p<0.05). In the presence of various CPF concentrations, insulin secretion stimulated by 25 mM glucose showed significant decreases (p<0.05) as well. PC2 enzyme activity was inhibited significantly at 70 min through 100 min post-exposure (p<0.05). In conclusion, our results demonstrate that CPF inhibits insulin secretion in RIN cells possibly through inhibition of PC2 enzyme activity.

Motion and Drug Induced Emesis in Suncus Murinus

Student Presenter: Rachel Brame

Faculty Mentor: Dr. James Lucot

Department: Pharmacology and Toxicology

There remains a great need for a more efficacious and universally effective antiemetic (anti-nausea/vomiting). The needs range from chemo- and radiation therapy patients, those with various illnesses and disorders and those exposed to provocative motion. Research has been conducted using cats, dogs, pigeons,

ferrets, pigs and shrews as emetic models. The research at Wright State University uses the Japanese house musk shrew (*Suncus Murinus*) as a model species. These are a continuation of our initial studies using cats in which we discovered a novel mechanism to prevent vomiting produced by all known stimuli. Three emetic stimuli using different pathways to stimulate the vomiting coordinating area were used to evaluate the breadth of the efficacy of a proprietary drug devoid of the side effects that plagued the initial studies. Motion sickness (vestibular pathway) was elicited using linear horizontal motion of 30 mm at 1 Hz for ten minutes. Nicotine (chemical trigger zone) was injected at 4 and 10 mg/kg subcutaneously and observed for 30 minutes. Cisplatin (chemotherapy; vagus nerve) was injected intraperitoneally at the dose of 10 mg/kg and they were observed for two hours. All tests were given with one week intervals to prevent conditioned emesis. The proprietary drug was effective against each stimulus and pharmaceutical support is being sought for further development.

Mismatch of Caloric Intake and Body Fat when Fructose is provided during the Sleeping Phase

Student Presenter: Iara Cristina de Araujo

Faculty Mentor: Dr. Mariana Morris

Department: Pharmacology and Toxicology

Purpose: There are concerns that high fructose consumption in humans may result in obesity and metabolic dysfunction. There is little information on whether the timing of fructose intake has an impact on the resultant pathologies. We conducted studies in mice to determine whether the timing, fructose available during only the light or dark periods, would affect body weight, body fat, glucose tolerance and total calorie intake. Methods: C57BL/6 male mice (10/group) were given

either water or a 10% fructose solution ad libitum for six weeks. Groups were control (C, water only); fructose light (F12L, 12 hr fructose during light and water during dark; fructose dark (F12D, 12 hr fructose during dark and water during light. Eco MRI was used to measure body composition (fat, lean, total water and free water). Glucose tolerance was measured using an ip glucose injection (1.5g/kg). Results: After 6 wks on the diet, there were no significant differences for glucose tolerance, body weight, food or total caloric intake among the groups. F12L consumed more water as compared to F12D (8.5 ± 0.3 vs. 6.7 ± 0.7 mL). F12D consumed more than twice the amount of fructose as compared to F12L (15.7 ± 0.5 mL vs. 7 ± 0.4 mL). Even though the caloric intake was the same, F12L showed greater body fat than F12D or C (3.1 ± 0.2 , 2.6 ± 0.2 and 2.4 ± 0.2 g, F12L, F12D, C, $p < 0.01$). Conclusion: Data show that the timing of fructose consumption has important pathological consequences. When the sugar was consumed during the normal sleeping phase, there was an enhanced obesogenic action, providing implications for dietary habits in humans.

Co-Author(s)/Collaborator(s): Roberta

Pohlman, Mariana Carbonaro, Swapnil Shewale, Mary Key

Low Dose Sarin (0.4 LD 50) Causes Delayed Cardiac Remodeling and Reduces Left Ventricular Function.

Student Presenter: Lisa Daxer

Faculty Mentor: Dr. Mariana Morris

Department: Pharmacology and Toxicology

It has been reported that low dose Sarin (an organophosphate agent that acts by irreversibly binding to acetyl cholinesterase) is associated with long-term pathology in the brain and heart; however, the effects of Sarin on the cardiovascular system are not yet well-defined.

Sarin has been implicated as an etiological agent in Gulf War Illness; thus, the role of Sarin in producing long term illness has important military implications. This study used Echocardiography (for determining the structure and function of the LV), Electrocardiography, and histology to determine Sarin's effect on the murine cardiovascular system. C57BL/6J mice were injected with either Sarin 0.4 LD 40 or saline on two consecutive days and studied for 10 weeks after exposure. In the Sarin animals, measurements showed a marked increase of the heart-to-body-weight ratio ($p = 0.026$) and a significant decrease in the size of the left ventricular lumen ($p = 0.0014$). Cardiomyocytes were significantly larger in the Sarin mice ($p = 0.025$), and atrial and brain natriuretic peptide levels were increased ($p = 0.028$ and 0.010 , respectively). Analysis of the electrocardiograms showed significant ST/T-wave changes in the Sarin groups ($p = 0.0015$ and 0.032 , respectively). Similarly, Echocardiography showed altered structure (End Systolic and Diastolic Areas) and significantly decreased performance (Ejection Fraction) of the left ventricle in the Sarin animals at 10 week time point. This study indicates that Sarin plays a role in cardiac remodeling and the reduction of cardiac performance.

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Michael Horenziak

Role of the aryl hydrocarbon receptor in TCDD-induced alteration of immunoglobulin expression

Student Presenter: Michael Wourms

Faculty Mentor: Dr. Courtney Sulentic

Department: Pharmacology and Toxicology

Dioxin exposure is known to cause chloracne, hepatotoxicity, and immune suppression. The prototypic compound for studying dioxin

toxicity 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) inhibits immunoglobulin (Ig) secretion in B cells. TCDD-induced inhibition of Ig secretion is thought to be modulated in part through transcriptional down regulation of the Ig heavy chain (IgH) locus. Although several regulatory elements control the IgH locus our research focuses on the 3'IgH regulatory region (3'IgHRR) that contains dioxin responsive elements (DRE) in two of its constituent hypersensitive regions, hs1,2 and hs4. The heterodimer of the aryl hydrocarbon receptor (AhR) and the aryl hydrocarbon nuclear translocator (ARNT) binds to DREs upon ligand (i.e. TCDD) activation. In previous luciferase reporter studies TCDD treatment in LPS-activated B cells up-regulates the hs4 region but down-regulates the 3'IgHRR. Moreover, the hs4 region contains an overlapping DRE and κ B motif that have been proposed to act in concert to regulate the hs4 enhancer. The purpose of the current study is to develop an AhR-deficient model in the well-characterized CH12.LX mouse B-cell line in order to further elucidate TCDD-induced AhR regulation of the 3'IgHRR and its enhancers. Stable lentiviral-mediated insertion of two shRNA constructs targeting AhR message achieved approximately 50% AhR knockdown in a heterogenous population of cells as verified by Western blot analysis. Furthermore, activity of the hs4 enhancer following LPS and TCDD co-treatment was significantly reduced in the AhR-deficient cell population. These results suggest that the AhR plays a significant role in activation of the hs4 enhancer. Furthermore, current studies are focused on utilizing this AhR-deficient model to determine the role of the AhR in TCDD-induced modulation of the 3'IgHRR which should significantly contribute to understanding the mechanisms behind altered Ig transcription and B-cell function by TCDD. (Supported by NIEHS R01ES014676 and NIEHS Supplement for Undergraduate Research Experience)

Role of specific protein binding motifs in TCDD-induced activation of the human polymorphic HS1,2 enhancer

Student Presenter: Sharon Ochs

Faculty Mentor: Dr. Courtney Sulentic

Department: Pharmacology and Toxicology

The immunoglobulin heavy chain (IgH) gene is transcriptionally regulated in part by the 3'IgH regulatory region (3'IgHRR) which is located downstream of the IgH locus and in humans consists of three enhancers (hs3; hs1,2; hs4). Utilizing a well-characterized mouse B-cell line (CH12.LX), our previous results have demonstrated a sensitive inhibition of the mouse 3'IgHRR by 2, 3, 7, 8-tetrachlorodibenzo-r-dioxin (TCDD), a known disrupter of B-cell differentiation, which correlated well with TCDD-induced inhibition of IgH expression and Ig secretion. Interestingly, in humans a polymorphism of the hs1,2 enhancer (resulting in a varying number of tandem repeats of a 53 bp sequence) has been correlated with several autoimmune diseases. The human hs1,2 enhancer is also sensitive to TCDD-induced modulation but in contrast to the mouse hs1,2 and 3'IgHRR, TCDD activated the human hs1,2 enhancer perhaps through altered binding to one or more transcription factor binding sites within the hs1,2 enhancer (i.e., DRE, kB, AP-1, Oct, SP1). The purpose of the current study was to elucidate the transcriptional regulation of the human polymorphic hs1,2 enhancer following TCDD induction. Utilizing site-directed mutagenesis, mutated luciferase reporter plasmids were designed containing a variety of binding site deletions (DRE, Oct, 53bp, Oct+53bp). These plasmids were transiently transfected into the CH12.LX cells then treated with TCDD in the absence or presence of lipopolysaccharide (LPS) stimulation. Deletion of the DRE site showed a modest increase in TCDD-induced activity; whereas deletion of both the Oct site and the 53bp repeat resulted in a complete loss of TCDD-induced activation. These results suggest that there is a concerted

activation of the polymorphic hs1,2 enhancer involving Oct and a site within the 53 bp repeat that may be independent of the DRE. Studies are ongoing to evaluate the role of the AP-1 site in relation to these effects. (Supported by NIEHS R01ES014676)

Polymorphisms of the HS1,2 enhancer of the 3'IgH RR and the association with Celiac Disease

Student Presenter: Todd Lewis

Faculty Mentor: Dr. Courtney Sulentic

Department: Pharmacology and Toxicology

Celiac Disease (CD) is an autoimmune disorder that manifests when an individual is exposed to gliadin, a gluten found in wheat. Upon exposure to gliadin, the enzyme tissue transglutaminase modifies the protein causing an inflammatory response in the small intestine that truncates the villi lining. Since the villi are truncated the absorption of nutrients is greatly diminished. In humans the 3'IgH RR is located downstream of the IgH locus and is composed of four enhancers. This study will focus on the HS1,2 enhancer, in which there are two: one (HS1,2-A) is 3' to the $\text{C}\alpha$ -1 gene and the other (HS1,2-B) is 3' to the $\text{C}\alpha$ -2 gene. There are four polymorphisms of the $\text{C}\alpha$ -1 HS1,2-A alleles (1a,2a,3a, and 4a) and two polymorphisms in the $\text{C}\alpha$ -2 HS1,2-B alleles (3b, 4b). Previous studies have demonstrated that allele 2 is at a higher frequency in individuals with autoimmune disorders such as CD. The polymorphisms also have varying frequencies in different populations. Individuals from African descent have a very low frequency of allele 2a and an increase in frequency of the allele 3a. The objective of this project is to compare the allelic frequency of patients diagnosed with CD to control non-CD patients. Current studies have focused on optimizing the isolation and PCR analysis of human genomic DNA isolated from buccal cells using a dH₂O mouthwash.

Genomic DNA was successfully isolated and the HS1,2-A and HS1,2-B regions were analyzed by nested PCR to identify the polymorphic alleles.. Allelic frequencies will be assessed to determine if there is a statistically significance association of a particular allele with a CD patient population.

Analysis of Adiposity in Mice: Method Development

Student Presenter: Naima Salem Rodman

Faculty Mentor: Dr. Mariana Morris and Dr. Roberta L. Pohlman

Department: Pharmacology and Toxicology

Purpose: To setup a method to measure area and diameter of fat cells in white adipose tissue from mice. The plan is to use the best method for the study of fat metabolism in a murine model of diabetes. Methods: We tested two methods: 1) Oil Red to stain the lipid in fat cells in frozen tissue sections and 2) Paraformaldehyde fixed and paraffin embedded adipose tissue stained with hematoxylin and eosin (H&E). Oil Red is a lipophilic dye which penetrates the cells, outlines the cell membrane and stains the nucleus a blue color. Results: Results showed that the Oil Red stain did not work well with the frozen tissue sections. The temperature required for sectioning fat was below the range of the cryostat. Histological examination of the tissue showed that the cell membranes were deformed, allowing the oil red stained fat to leak out. In contrast, the results with the H&E stained, fixed tissue was much better. The adipose tissue was clearly preserved showing a network of fat cells, resembling a wire mesh. Using this method, it will be possible to measure cell size and number, combining photomicroscopy with computer imaging methods. Future Work: The next step will be to conduct studies in an animal model of diet

induced diabetes, examining the changes in adiposity.

AFRL/RHPB, WPAFB, Pharmacology and Toxicology, WSU

Modulation of NF- κ B Pathway by Gold Nanoparticles in B cells

Student Presenter: Monita Sharma

Faculty Mentor: Dr.Saber Hussain and Dr.Courtney Sulentic

Organization: AFRL/RHPB, WPAFB, Pharmacology and Toxicology, WSU

Almost all cells express NF- κ B, which can be activated or inhibited in response to over 200 chemical, physiological and environmental stimuli. Gold compounds (for instance, aurothiomalate and aurothioglucose) have been shown to block the activity of I κ B kinase, through their interaction with a cysteine residue on the enzyme, leading to inhibition of NF- κ B activation. Since gold nanoparticles (colloidal gold) also have an affinity for thiol groups, this study hypothesizes that the metal sensitive I κ B kinase can act as a potential target for gold nanoparticles to bind and modulate the activity of NF- κ B. This study aims at providing a better understanding of how gold nanoparticles affect the NF- κ B signaling pathway, using a murine B cell line as the model system. Preliminary data, using reporter assays, suggested that gold nanoparticles downregulate the activity of NF- κ B in B cells and increased the mitochondrial function in the B cell line being tested. Since NF- κ B has been implicated in significant cellular functions involved in immune system and stress responses, these results suggest that the function of B cells and perhaps other cells systems could potentially be compromised by gold nanoparticles. With the ever expanding list of biomedical applications such as biosensors,

real time monitoring of cellular environment, it is especially important to assess the impact of gold nanoparticles on the cellular functions before they can be safely used for nanomedicine.

Physics

Solar Pumped Laser

Student Presenter: Ian Fuller, Aaron Archibald

Faculty Mentor: Dr. Jason Deibel

Department: Physics

The design, engineering, and implementation of a solar pumped Nd:YAG laser system is described here within. This Nd:YAG laser is unique in that the laser crystal is pumped using solar energy directly culminated by a system of Fresnel lenses, and is mounted in a custom 'hybrid pumping' laser cavity. Such a cavity will allow for maximum efficiency by pumping the laser crystal from the end, as well as from the sides. This method differs from current research into solar pumped lasers not only due to this unconventional pumping method, but also because of the pumping source itself. Rather than using electricity generated by solar cells to power a diode laser, this system directly converts sunlight into laser light. Lasers are not commonly referred to as efficient devices, often achieving only 0.1%, to a maximum of only 30% efficiency; and ultimately draw their power from electricity generated by standard means. By using a clean energy source, such as solar power, to energize the laser, the operating costs are negligible. On average, 1000 watts of solar energy are reaching every square meter of the earth's surface during peak daylight hours. This makes it possible to produce a high power laser beam, despite the inherent inefficiencies. Dr. Takashi Yabe, of the Tokyo Institute of Technology, has recently built one of the most efficient solar pumped lasers known which utilizes this method. This

was reported to have produced an output of 80 watts with a net conversion efficiency of 4.3 percent. The members of this project team have referenced Yabe's research as a guideline; however, we do not intend to duplicate his system. By scaling down the system the laser can be demonstrated and may advance the possibility of utilizing these lasers in a number of clean energy generation schemes or satellite laser technology.

Terahertz Time Domain Spectroscopy with Parallel Plate Waveguides

Student Presenter: Lindsay Owens

Faculty Mentor: Dr. Jason Deibel

Department: Physics

The Terahertz (THz) spectral range has received considerable attention for the development of non-destructive evaluation applications. This is due to the relatively high transmission through most dielectrics and high reflectivity off of metallic surfaces. THz spectroscopy can provide a non-destructive, standoff analysis technique capable of detecting corrosion on metallic surfaces under obscuring conditions and defects in composite materials on aerospace structures. Such techniques have been utilized in the X-ray region of the spectrum, but unlike X-rays, THz is non ionizing and non destructive, enabling it to be safer for the user, and cause no harm to the sample. For the case of thin film samples however, there is not enough interaction between the signal and the sample to do an accurate analysis of the sample. The use of a parallel plate wave guide, with a thin film sample on one of the plates will increase interaction time between the signal and that sample, allowing for an in-depth analysis of different types of thin film samples.

Characterization of laser micro machined terahertz metallic wire waveguides

Student Presenter: Satya Ganti

Faculty Mentor: Dr. Jason A. Deibel

Department: Physics

Terahertz radiation, a region of the electromagnetic spectrum which lies in between the microwave and infrared, has gained considerable attention recently due to interesting properties exhibited by materials exposed to this radiation. The uniqueness of the use of THz radiation for sensing and imaging applications lies in the notion that THz is easily transmitted through non-metals. People have witnessed how fiber optics operating in the visible region of the spectrum has brought us closer across the world. A crucial step in the future application of terahertz technology is the development of waveguides that work well at these frequencies. Our present work is to characterize the laser micro-machined metallic waveguides using terahertz time-domain spectroscopy and imaging. The THz pulses emitted at the transmitter excite the surface plasmon polaritons of the metal wave guide and propagate as surface waves that are detected at the receiver end. THz pulses are generated by driving a photoconductive antenna with an ultrafast laser, focused on to the plasmonic lens which produces radially polarized light, in turn coupled to the metal waveguide and detected at the end with another photoconductive antenna. We will continue our work by investigating different geometries of the cylindrical and tapered metal waveguides by varying the diameter and length of the wires and also on the most effective metal to be chosen as the waveguide depending on the conductivity, melting point of various metals and operating conditions. Understand the physics behind mechanisms such as coupling, loss, dispersion, and electric field confinement of these surface waves along the waveguide. The success of this work will replace the complex free space optics used in terahertz systems and also reduce cost.

Co-Author(s)/Collaborator(s):Zachary A. Gault

Optimization of Terahertz Wire Waveguide through Finite Element Simulations

Student Presenter: Zachary Gault

Faculty Mentor: Dr. Jason A. Deibel

Department: Physics

The “terahertz” gap lies between the microwave and infrared regions of the electromagnetic spectrum. Terahertz radiation light has been in the past difficult to work with, but the field has grown considerably due to the recent development of promising experimental techniques to create, guide, and manipulate terahertz radiation. We investigate one of these techniques, the guiding of terahertz waves on the surface of metal wires. We report optimization of terahertz metal wire waveguides through the use of finite element method (FEM) simulations. The goal of this research is to utilize our novel waveguides to create a terahertz near-field microscope. Tapering wires allows for focusing of the radiation to sizes smaller than the diffraction limit. Periodic corrugations along the surface of the wire help confine the extent of the radial electric field. Our simulations study how frequency, taper rate, as well as corrugation width, depth, and spacing affect the propagation of terahertz radiation. The optimized waveguides will then be fabricated at Mound Laser and Photonics Center (MLPC), which has developed laser etching techniques that can create both the tapers and corrugations. The fabricated waveguides will be characterized in our lab, and assembled into the proposed near-field microscope

Co-Author(s)/Collaborator(s):Stanley Smith IV, Satya Ganti, Nicholase Schroeder, Carl Druffner

Control of and Data Acquisition from a Torodial Electrostatic Analyzer

Student Presenter: Jack Owsley

Faculty Mentor: Dr. Gary Farlow

Department: Physics

We have written LabView programs for use with a Toroid Electrostatic Analyzer. The first program was created to control the high input voltage. The input voltage (25,000V-30,00V) is applied to the deflection plates inside the electrostatic analyzer, which will correctly pass the desired energy of an ion beam for data collection. The LabView voltage control program allows the user to have complete control of the input voltage due to a series of loops which increases the voltage in small increments, not allowing any radical voltage jumps which will endanger the power supply and the experiment. Once the high voltage has reached its limit, the program allows the user to initiate a countdown sequence which decreases the voltage, in small increments, until the voltage supply has reached its initial state of zero volts. The second program collects the data that is produced. This program also stores the data and produces both energy and scattering angle histogram. Both programs have been tested using low power test equipment and produce expected results. Due to high radiation of the high voltage supply, it is necessary to have both programs under remote user control. Remaining work includes the connection of the two programs to high voltage supplies and signal shaping electronics.

Co-Author(s)/Collaborator(s): John Middendorf

Optical Characterization of Composites for Quantitative Analysis of Terahertz Images

Student Presenter: Carla Benton

Faculty Mentor: Dr. Doug Petkie

Department: Physics

Terahertz (THz) imaging being developed for non-destructive evaluation applications yields both promising results and questions about how the properties of the materials being

imaged interact with the radiation. To explore this, transmission measurements were made and a polarizing Michelson interferometer was designed and built for measuring the index of refraction of high loss materials. The system was tested on known materials and then used to measure the index of the samples of interest. In order to try to understand how the different measurements and the images fit together, a model of the imaging process was developed and the results compared to the actual THz images.

Absorption of THz Radiation by Atmospheric Water Vapor

Student Presenter: John Cetnar

Faculty Mentor: Dr. Doug Petkie

Department: Physics

THz radiation is electromagnetic radiation that exists between the microwave and the infrared regions of the electromagnetic spectrum. It is non-ionizing radiation and can penetrate through materials that are opaque to visible light so therefore has many new and exciting applications. Systems employing THz radiation are becoming more common. Due to water vapor, Earth's atmosphere heavily attenuates THz radiation in certain regions and therefore represents a challenge to communications and sensing applications at these frequencies. The theory of how the atmosphere attenuates propagating THz radiation by absorption and scattering will be discussed. The absorption of THz radiation by water vapor was measured at 325 and 620 GHz using frequency domain absorption spectroscopy. Spectral line shapes were recorded across a range of pressures and fitted to Voigt profiles. The resulting relationship between the line width and pressure was shown to be linear and in agreement with published values. The transient signals associated with population and polarization relaxation times were also

measured at 325 GHz using time domain spectroscopy techniques. Experimental results associated with the frequency and time domain measurements will be discussed.

Political Science

Engaged Buddhism in Southeast Asia: Building Civil Society and Support for Human Rights through Socio-Political Movements

Student Presenter: Dana Fleetham

Faculty Mentor: Dr. December Green

Department: Political Science

In the Southeastern Asian nations of Thailand, Burma, Vietnam, Laos, and Cambodia, Buddhism has a long history of intertwinement with political power, where it has served to legitimize many ruling regimes and has provided, in some cases, an influential moral structure for governance. The sangha (community of monastics) has traditionally been associated with spiritual matters, and while not believed to be wholly apolitical, has not generally sought to meddle in matters of the state. Over time however, the sangha has diverged from patterns of symbiotic association between the sangha and the state and has become aligned instead with the people, choosing to advocate for human rights and democracy in ethics-based movements now common enough to be termed 'engaged Buddhism' or 'socially-engaged Buddhism.' These movements, regardless of their political, economic, or social contexts, all share the following characteristics: support and influence from individuals of the sangha, a professed interest in defending the rights and interests of the people, and a use of Buddhist texts and scriptures to substantiate their allegiance to serving people versus the state. As a result, new communities of social action are being formed, the existence of which create the purpose for this inquiry. How do these social

movements serve to promote human rights and democracy within the community that they serve? What is the textual basis in Buddhism for human rights and democracy?

Psychology

An Examination of Functional and Non-Functional Earliness in Employees

Student Presenter: Cristina Kirkendall, Mike Hoepf

Faculty Mentor: Dr. Nathan Bowling

Department: Psychology

Researchers have not examined a distinction between types of earliness. The current study examines the relationship between conscientiousness, job satisfaction, organizational citizenship behavior (OCB), counterproductive work behavior (CWB), and functional and non-functional earliness. We found that job satisfaction, OCBs, and CWBs are correlated with functional and non-functional earliness.

Changes in occupational stressors and affective-oriented criterion: A longitudinal assessment

Student Presenter: Kevin Eschleman

Faculty Mentor: Dr. Nathan Bowling

Department: Psychology

The role of occupational stressors on employee well-being, attitudes, and behaviors is well established in previous research, but the how these relationships occur over time is still unclear. Occupational stressors, job satisfaction, commitment to an organization, and frustration were measured at three time points over six months. Results were analyzed using Latent Growth Modeling. In general, changes in occupational stressors were associated with changes in job satisfaction,

commitment, and frustration. For example, as occupational stressors increased over six months, job satisfaction and commitment decreased and frustration increased.

Work locus of control: A better predictor of work criteria

Student Presenter: Qiang Wang

Faculty Mentor: Dr. Nathan Bowling

Department: Psychology

The current meta-analysis examines the potential correlates and consequences of work locus of control. Results indicated that work locus of control was associated with job attitudes, employee well-being, job performance, career success, employee withdrawal, work stressors, autonomy, interpersonal relationships at work, and problem-focused coping. Additional analyses found evidence that work locus of control was a better predictor of work-related criteria than was general locus of control and that general locus of control was a better predictor of general criteria than was work locus of control. Path analyses further found that the effects of general locus of control on work-related criteria were largely mediated by work locus of control. Finally, work locus of control was related to other personality traits, such as general locus of control, general self-esteem, and negative affectivity, but was unrelated to employee demographics.

Co-Author(s)/Collaborator(s): Kevin J. Eschleman

The Moderating Effects of Situation Strength on the Job Satisfaction-Job Performance Relationship

Student Presenter: Steve Khazon

Faculty Mentor: Dr. Nathan Bowling

Department: Psychology

Debates about how individual differences interact with the situational context have been around for a long time. However while individual difference variables have been relatively well defined, situational variables have not. That is, situational strength lacks a unified conceptualization. The present study examined the moderating effects of two recently proposed facets of a newly introduced unified situational strength construct: constraints and consequences, on the relationship between job satisfaction and job performance. Our analyses showed that while constraints appear to moderate the performance-satisfaction relationship ($\beta = -.34$, $p < .01$), consequences do not ($\beta = .07$, ns). The implications of these findings are discussed.

Career Indecision and Personality: A Multidimensional Perspective

Student Presenter: Joshua Taylor

Faculty Mentor: Dr. Gary Burns

Department: Psychology

In the area of vocational psychology, there has been a tremendous interest in the topic of career indecision(CI). In reviewing the literature, it is hard to ignore that the driving force behind this research trend has been the development of the Career Decision Scale (CDS) by Osipow and his colleagues(Osipow et al. 1976). Although this measure was published and widely used as a unidimensional scale, it has become evident that the CDS has an underlying multi-dimensional structure that could potentially differentiate between different types of CI (Vondracek et al., 1990). The present study will evaluate the factor structure of the CDS using confirmatory factor analysis and then examine the relationships between the four dimensions of CI and the big five personality factors. Two-hundred eighty-five students enrolled in psychology courses at a Midwestern University completed an online

survey for course credit. Each participant completed the Career Decision Scale (CDS; Osipow et al., 1976) and the 50-item IPIP Big Five Questionnaire (IPIP-NEO; Goldberg, 1999). The IPIP-NEO measures the Big Five personality factors of Neuroticism, Extraversion, Openness, Agreeableness, and Conscientiousness. Our results indicate that the multidimensional scale fit better than the unidimensional model. Working with this measurement model, a structural equation model was created to examine the relationship between personality and the two scales. In examination of the unidimensional scale, only the personality trait of emotional stability was found to be significantly related. In contrast, the multidimensional scale was found to have a number of personality trait correlates. The evidence that emotional stability is not the only personality factor which plays significant role is a tremendous insight into career indecision.

Designing for Human-Centered Systems: Situational Risk as a Factor of Trust in Automation

Student Presenter: LeeAnn Perkins

Faculty Mentor: Dr. Gary Burns

Department: Psychology

As society continues to become advanced in technology, automation is increasingly implemented in systems reducing the need for human intervention. Although the system is the main focus in rendering the cognitive workload, the human's use as a trust decision in the system is the main component for successful performance. Trust is a prime factor in building a symbiotic relationship between human-automation interaction, and further empirical research is needed to develop appropriate methods for designing trusted systems. These methods can be defined as identifying the prime factors of trust that influence the user's decision making. The focus of this paper looked

at the factor of risk to determine if and how risk in a situational environment was an influencing factor of trust in automation. A Global Positioning System (GPS) was used as the automated platform, and participants went through a series of route planning with varying levels of risk and hazards. It was found as the level of risk increased on hazards, the use and trust of automation decreased.

Selecting Small Targets With Gaze Alone: Is Zooming the Answer?

Student Presenter: Julio Mateo

Faculty Mentor: Dr. John M. Flach

Department: Psychology

Selecting the smallest targets in mainstream graphical user interfaces (GUIs) with gaze alone is difficult due to the limited pointing accuracy of gaze input when compared to mouse input. Approaches to address the limited accuracy of gaze pointing include those aimed at reducing the noise of the pointer (e.g., smoothing) and those aimed at increasing target tolerance (e.g., interface design). We focused on a subset of the second type of approaches: the design of interface tools that effectively increase the size of selectable objects in mainstream GUIs. We proposed a conceptual framework to organize existing interface tools and guide the development of new tools. Inspired by our previous attempts to use continuous zoom tools to increase the effective size of selectable objects in mainstream GUIs, we also designed a discrete zoom tool. To test the potential of our framework and tool, we conducted a proof-of-concept experiment in which participants performed a point-and-select task with small targets (i.e., 6- and 12-pixel wide). We compared the participants' performance when using no tool (i.e., dwell), a two-step magnification tool (often available in commercial gaze-tracking systems), or one of two versions of our discrete zoom tool. One of

these discrete-zoom-tool versions had the same magnification level and dwell time as the two-step magnification tool, whereas the other was optimized. Our results showed that the optimized discrete zoom tool was as fast as and more accurate than the two-step magnification tool. We conclude that our zoom framework shows potential to guide the design, development, and testing of tools to facilitate the accessibility of mainstream interfaces for gaze-input users. Furthermore, we argue that the use of discrete zoom tools that fall between the two ends of the spectrum (i.e., two-step magnification and continuous zoom) can potentially be helpful in certain gaze-interaction situations.

Co-Author(s)/Collaborator(s):Henrik Skovsgaard

Juvenile Deficits Revealed in the Pitx3 Model of Parkinson's Disease

Student Presenter: Chris Powers, Heather Booth

Faculty Mentor: Dr. Gale A. Kleven

Department: Psychology

Recent evidence has revealed connections between prenatal insults and the development of Parkinson's disease, a neurodegenerative disorder that affects motor function. In the Pitx3ak/2J mouse model, dopaminergic neurons in the substantia nigra do not differentiate thereby disrupting the developing nigrostriatal pathway (Hwang et al., 2003). In humans, PITX3 alteration is highly correlated with an early onset of Parkinson's (Bergman et al., in press). Because the Pitx3 mutation in mice has profound effects on early development, and humans with alterations in PITX3 often present with Parkinson's at younger ages, we hypothesize that behavioral testing of the Pitx3 mouse mutant should reveal deficits in juveniles and young adults, confirming Pitx3ak/2J as an early-onset mouse

model for Parkinson's disease. Adult wild-type C57BL/6J, Pitx3 mutant mice, and rd1 blind controls were tested longitudinally as juveniles at one month (P30) and as young adults at two months of age (P60) in an open field and pole climbing task. To confirm that alterations in behavior resulted from reduced striatal functioning, localized MRS data from the dorsal striatum were collected from both juvenile and adult mice. Because changes in the levels of neuronal metabolic markers in the basal ganglia have been suggestive of Parkinson's disease (Koga et al., 2006; Rango et al., 2006), concentrations of choline (Cho) and N-acetyl aspartate (NAA) were measured and analyzed at each age. Functional deficits (longer descent, increased rotation, and decreased rearing) and changes in striatal metabolites were detected at the earliest time point tested (P30), corresponding to juvenile development in humans. Together, these results affirm our hypothesis of early onset motor dysfunction in the Pitx3 mouse model of Parkinson's disease. Further study of this model may provide crucial information on the early emergence of this disease process and new insight into how developmental mechanisms may contribute to adult disease.

Epigenetic Rearing Factors in a Genetic Model of Parkinson's Disease

Student Presenter: Kelly Leach, Connie McGlone

Faculty Mentor: Dr. Gale A. Kleven

Department: Psychology

In the Pitx3ak/2J mouse model of Parkinson's disease, midbrain dopaminergic neurons fail to differentiate in the substantia nigra par compacta (SNc). However, prior studies using this model have reported inconsistencies on behavioral tests of functional deficit expected in a Parkinson's disease model (Hwang et al., 2005; Kas et al., 2008). Because different

breeding schemes were used by the various investigators, we hypothesize that epigenetic factors, such as rearing environment and maternal-offspring interactions, may be contributing to these inconsistencies. In order to test this hypothesis, *Pitx3* heterozygous females were mated to homozygous males (3:1), producing litters with a ratio of 50:50 heterozygote to homozygote offspring. From litters born within a 24 hour period, all pups were cross-fostered to the dams in order to create 3 types of rearing environments: homogeneous mutant, homogeneous heterozygous control, and mixed mutant and control. Offspring from these three rearing conditions were tested behaviorally at 2 months of age (P60) as adults in an open field and a pole climb task. For most behaviors, there was a main effect of Rearing Condition between mice raised in litters of homogeneous versus mixed configuration. Furthermore, a 3-way Genotype x Gender x Rearing Condition interaction was seen in the frequency of exploratory behaviors in the pole climb task, suggesting that male and female mice are differentially affected by the type of rearing condition for some behaviors. Together, these results demonstrate that differences typically attributed to genetics alone may also include epigenetic factors such as breeding schemes and litter configurations. Consideration of these epigenetic factors may be necessary when interpreting behavioral results from genetically altered mice.

Is attentional capture by irrelevant color stimuli affected by expectancies?

Student Presenter: Leia Lander

Faculty Mentor: Dr. Allen Nagy

Department: Psychology

Previous research has indicated that the presence of a salient stimulus (singleton) affects the detection of relevant less salient

stimuli in a search task (Theeuwes and Godijn 2001). A salient novel stimulus seems to capture attention. Recent evidence suggests that effects may be stronger when the salient singleton is presented randomly on only 20% of trials rather than every trial (Geyer, Muller, and Krummenacher 2008). Previous research from our lab suggests capture by a singleton is contingent on the relationship between the color of the target stimulus and the singleton distractor color (Amster 2005). However, there is debate as to whether involuntary capture by an irrelevant singleton is contingent on the relevance the singleton has to the observer's task (Wright and Ward 2008). This study examined if capture by an irrelevant singleton was contingent on the relationship between the singleton color and the less salient color target, if the singleton appears randomly on a relatively small percentage of trials. One block of trials with no singleton present was conducted as a control condition followed by a block of trials with an irrelevant singleton present on 20% of trials. Four different singleton colors were used: red, blue, green, and bright white; but the singleton was always red. A second experiment with singletons present on 100% of trials was also conducted and results were compared with 20% conditions. We expected detection of a target to be poorer when singletons were present in 20% conditions versus the 100% conditions, but this hypothesis was not supported. Data did support our general hypothesis that attentional capture is contingent on the proportion of trials the singleton is present and the color of the salient singleton.

Haptic Processing in Dual Tasks

Student Presenter: Caleb Hildenbrandt

Faculty Mentor: Dr. Pamela Tsang

Department: Psychology

This study will examine the potential for separate attentional resources for haptic and visual processing. The multiple resource model hypothesizes that we have limited attentional resources and different tasks consume different, non-interchangeable attentional resources. For instance, a listening task consumes auditory input resources and a visual task consumes visual input resources. This model hypothesizes that multiple tasks that draw attention from different resources can be time-shared more efficiently than if they have to compete for the same attentional resources. It has not been shown, however, whether haptic input is processed using a dedicated attentional resource, or if haptic input is processed using resources also used for visual processing. To test this hypothesis, we will use tasks involving visual and haptic inputs. In the single-task trial, there will be only one target object presented visually or haptically. Holding this target in memory, subjects will have to process a series of objects one at a time during the trial to determine whether the object is the same as the target. In the dual-task trial, two target objects will be presented. There are three dual-task conditions. The two target objects will be presented in one of the following ways: (a) both visually, (b) both haptically, or (c) one visually and one haptically. Greater resource competition and thereby poorer dual-task performance is predicted for the same-modality conditions than the mixed-modality condition if there exist separate visual and haptic resources.

Qbase and Tec^Edge Discovery Lab

Electronic Patient Care Tracking

Student Presenter: Greg Chaney, Heather Zumstein

Faculty Mentor: Ed Wasser

Organization: Qbase and Tec^Edge Discovery Lab

There is a need for technology innovations that can help improve medical care while reducing its cost. The Electronic Patient Care Tracking (EPCT) project is an AFRL rapid prototyping center sponsored project designed to explore the integration of technology innovations to create a medical care tracking capability. In EPCT, the goal is to develop a capability for first responders be able to gather information and store it on an RFID wrist band to keep accurate on-scene emergency care information with the patient from first responder to first provider. This project was organized and conducted at the Wright Brother's Institute Tec^Edge Discovery Lab as a collaboration of AFRL and WSU to give students an opportunity for "experiential learning" under AFRL's Academic Leadership Pipeline Scholarship (ALPS) program.

School of Professional Psychology

Psychotherapy and the Black Church: Helping Mental Health Professionals Understand the Spirituality of African Americans

Student Presenter: Angela Harris

Faculty Mentor: Dr. Richard Sears
School of Professional Psychology

The Black church has played an instrumental part in the lives of African Americans in the United States. The Black church continues to support the African American community by providing social, emotional, spiritual, temporal, and financial help. In recent years, both counseling and psychology fields have researched the importance of spirituality and its influence on the mental wellness of African Americans. Historically, the Black church has played a significant role in the improvement of education and an awareness of health and

wellness in African American communities. Furthermore, the Black church has always and continues to be held in the highest esteem by African Americans. Though the Black church has played such a significant role in the life of African Americans there continues to be limited information on how mental health professionals can meet the needs of the Black church and its members. When wellness and mental health services are brought to the Black church members are likely to participate if endorsed by the minister and members of the congregation. The presentation will highlight spiritual and cultural practices such as prayer, faith healing, and gospel music and how these practices serve as coping strategies for Black church members when dealing with mental health issues. Furthermore, mental health providers will be provided with valuable information that maybe helpful in psychotherapy when working with African American clients and collaborating with the Black church. Further research is needed to examine the influence of the Black church, worship, and traditional mental health approaches on African American clients.

Tec^Edge Discovery Lab

Micro-air Vehicles, Robotics, and Sensor Tracking

Student Presenter: Kathleen Timmerman

Resarch/Faculty Mentor: Dr. John Vickery, Dr. Rob Williams Civ USAF AFRL/RYA and Dr. Mateen Rizki

Organization: Tec^Edge Discovery Lab

Micro-air vehicles (or MAVs) are becoming an increasingly important technology with promising applications in defense, security, and commercial areas. A team of undergraduate students in engineering and computer science is developing a prototype MAV to demonstrate the detection and tracking of interesting

moving objects, some of which may be ground based lego robots. The team has been developing a prototype MAV around a quadrotor design to which sensors, communications, controls, and special software will be developed and integrated. The MAV and ground based robots will also communicate with a centralized artificially intelligent (AI) process that gathers information from all moving and stationary sensors, makes decisions, and deploys moving sensor platforms as needed. This project is organized and conducted at the Wright Brother's Institute Tec^Edge Discovery Lab as a collaboration of AFRL and WSU to give students an opportunity for "experiential learning" under AFRL's Academic Leadership Pipeline Scholarship (ALPS) program.

High Performance Computing

Student Presenter: Lance Harris

Research Mentor: Dr. Rhonda Vickery

Organization: Tec^Edge Discovery Lab

High-performance computing (HPC) uses computer clusters and supercomputers to solve problems requiring complex computations or many iterations of a computation with ranges of multiple parameters. Often these huge computations produce large amounts of data that must be analyzed interactively. This project investigates the challenges of programming for the HPC environment and intelligently visualizing the data. We will show our work in progress for specific challenges being investigated by the Air Force Research Lab through the Tec^Edge Discovery Lab that will require greater reliance on HPC. This project is organized and conducted at the Wright Brother's Institute Tec^Edge Discovery Lab as a collaboration of AFRL and WSU to give students an opportunity for "experiential learning" under AFRL's Academic Leadership Pipeline Scholarship (ALPS) program.

TWITTINT

Student Presenter: Elizabeth Crawford

Research Mentor: Chris Rowley

Organization: Tec^Edge Discovery Lab

Layered Sensing is a technology being developed at the Air Force Research Laboratory in which layers of sensors that are capable of sensing physical things are integrated to create a common picture. This Twitter project explored the use of Twitter as yet another sensor except instead of physical sensing, it conducts social sensing or the mood of a region. This knowledge can be useful for emergency responders to know the state of the survivors dispersed around the disaster zone to quickly get a sense of which region is deemed to be more dangerous or scary to the population. This project was organized and conducted at the Wright Brother's Institute Tec^Edge Discovery Lab as a collaboration of AFRL and WSU to give students an opportunity for "experiential learning" under AFRL's Academic Leadership Pipeline Scholarship (ALPS) program.

City Beat and Social Networking

Student Presenter: Wesam Helou, Lisa Kralich

Research Mentor: Chris Rowley

Organization: Tec^Edge Discovery Lab

This panel presentation will feature the project City Beat which models patterns of social behavior, via direct and indirect sensors, in virtual environments to enable rapid hypothesis generation. This presentation will explain in great detail the program ORA and how the use of indirect sensors can improve the goals of this project. Audience participants can expect to engage in a dialogue with panelists about all the various features of ORA, social network analysis, or City Beat.

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