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Wright State University's Celebration of Research, Scholarship, and Creative Activities Book of Abstracts from Friday, April 11, 2014

Wright State University Office of Undergraduate Research and STEMM Activities

Wright State University's

Celebration of Research, Scholarship and Creative Activities

April 11, 2014

Student Abstract Booklet

A compilation of Abstracts from Students' Oral and Poster Presentations

Wright State University
urop@wright.edu

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Schedule of Events

Celebration Check-In **7:30 A.M. – 11:30 A.M.**

Location: Student Union, Skylight Lobby

Oral Presentation, Sessions 1—6 **9:00 A.M. – 11:20 A.M.**

Location: Student Union, E156A, B, and C, E157, E163A

Poster Presentations and Lunch **11:30 A.M. – 1:30 P.M.**

Location: Student Union, Apollo Room and Skylight Lobby

Oral Presentation, Session 1 **1:45 P.M. – 3:25 P.M.**

Location: Student Union, E156A, B, and C, E157, E163A

SAVE THE DATE

Celebration of Research, Scholarship & Creative Activities

April 10, 2015

Wright State University

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Biochemistry & Molecular Biology

Removal of Endogenous Phospholipids of Rhodobacter Sphaeroides Cytochrome C Oxidase Affects the Flexibility of the Enzyme

Student Presenter(s): Khadijeh Alnajjar, Graduate Student in Biological Sciences
FACULTY MENTOR: LAWRENCE PROCHASKA, PH.D.
DEPARTMENT: BIOCHEMISTRY & MOLECULAR BIOLOGY

The crystal structure of cytochrome c oxidase (COX) from Rhodobacter sphaeroides shows two phospholipids intercalated inside subunit III and four at the interface between subunits I, III and IV. These phospholipids are necessary for electron transfer, but their exact function in the structure of COX is still unclear. Phospholipids were removed from COX by incubation with molar stoichiometric amounts of phospholipase A2 for 3 hours at 4 °C in 20 mM MOPS pH 7.2, 20 mM CaCl2 and 0.2 % dodecyl maltoside. The enzyme was then washed on a cytochrome c-affinity column; phosphorous, iron and copper content was determined by inductively coupled plasma-mass spectrometry. Wild-type enzyme contained an average of 5 moles phosphorous per mole enzyme, while the delipidated enzyme contained less than one. Electron transfer activity in the treated enzyme was decreased 30% and it exhibited suicide inactivation. Inhibition of electron transfer activity and suicide inactivation were reversed by the addition of 1 mg/ml asolectin. The time dependence of α-chymotrypsin digestion of the enzyme showed that subunit I was digested at a faster rate in the delipidated COX, suggesting a more open conformation in the lipid-depleted COX. To further assess COX conformational flexibility upon delipidation, both COX forms were labeled in subunit III with a sulfhydryl group-directed fluorophore, N-iodoacetylamindoethyl-1-aminonaphthalene-5-sulfonate (IAEDANS). Fluorescence anisotropy measurements showed a 50% increase in the rotational rate of AEDANS-labeled delipidated COX. This increase in flexibility of subunit III affects the flexibility of the adjacent subunit I as shown by the higher chymotrypsin digestion rate of subunit I in the delipidated enzyme. Taken together, these data provide an explanation of the low turnover rates and suicide inactivation, both of which occur in COX in the absence of phospholipids.

The Use of an In Vitro Simulator for Modeling Human Gut Microbiota

Student Presenter(s): Harvey Anu, Graduate Student in Pharmocolgoy & Toxicology
FACULTY MENTOR: OLEG PALIY, PH.D.
DEPARTMENT: BIOCHEMISTRY & MOLECULAR BIOLOGY

In vitro human gut models present many advantages to investigating the human gastrointestinal tract. We recently developed and validated a custom human gut simulator. Here we illustrate how this system models the human proximal, transverse, and distal colon. First, we show how the system is controlled and mechanically replicates gut motility and physiological environment. We also highlight the ability of the gut microbiota to establish a stable and dense community within the simulator, while maintaining similar community structure to the fecal donor. We also show how gut microbiota communities respond to media simulating balanced American diet and a high protein diet.
Co-Authors/Collaborators: Richard Agans, and Oleg Paliy, Ph.D.

Microsatellite Stabilization by FANC J Helicase

Student Presenter(s): Joanna Barthelemy, Graduate Student in Biomedical Sciences
FACULTY MENTOR: MICHAEL LEFFAK, PH.D.
DEPARTMENT: BIOCHEMISTRY & MOLECULAR BIOLOGY

Myotonic dystrophy type 1 (DM1) is associated with expansion of (CTG)n · (CAG)n trinucleotide repeats (TNRs) in the 3' untranslated region (UTR) of the DMPK gene. (CTG)n · (CAG)n TNRs form noncanoncial hairpin structures in vivo. Noncanonical DNA structure-forming sequences stall replication forks in vivo, expand or contract during DNA replication, and represent hotspots of chromosome breakage. Since the frequency of hairpin formation is higher than the frequency of expansion or contraction, the cell may possess mechanisms to resolve hairpin structures prior to replication fork stalling. Possible mechanisms for hairpin resolution are DNA helicases known to unwind noncanoncial DNA structures. Genome instability disorders arise from mutations or loss of these DNA helicases including Fanconi anemia (FA). To test whether (CTG)n · (CAG)n TNR stability is protected by the DNA helicase associated with FA, FANC J, in human cells, model cell lines were created by integration of cassettes containing the c-myc replication origin and (CTG)n · (CAG)n TNRs in HeLa cells. Small pool PCR was used to assess genome instability after the loss of FANC J in the presence of a replication slowing agent, used to increase the probability of noncanoncial DNA structure formation. The data obtained from these experiments suggests FANC J is essential for the maintenance of (CTG)n · (CAG)n TNR stability.

Co-Author/Collaborator: Michael Leffak, Ph.D.

Fatty Acids and their Thioester Derivatives as Potential Endogenous Ligands of LXR alpha

Student Presenter(s): Shimpi Bedi, Graduate Student in Biomedical Sciences
FACULTY MENTOR: HEATHER A. HOSTETLER, PH.D.
DEPARTMENT: BIOCHEMISTRY & MOLECULAR BIOLOGY

The Liver X Receptor Alpha (LXRα) functions as a ligand-activated nuclear transcription factor by forming heterodimers with the Retinoid X Receptor (RXR). This LXRα-RXRα heterodimer modulates expression of genes involved in lipid and cholesterol homeostasis by binding to Liver X Receptor response elements (LXRE) in the promoter region of LXRα target genes. Upon ligand binding, LXRα undergoes a conformational change which allows for the recruitment of co-activators to this hetero-dimeric structure. Oxysterols have been identified as endogenous ligands of LXRa, and recently, the conjugated linoleic acid isomer trans-9, trans-11 was found to activate LXRa, suggesting that fatty acids (FA) or their thioester derivatives (FA-CoA) may bind to LXRα. As such, it is important to investigate the effects of lipids on ligand-activated LXRa activity. In the current study, we examine endogenous ligand binding of LXRa to FA and FA-CoA. Using spectro-fluorometry and circular dichroism spectro-scopy to detect changes in secondary structure, our data suggests binding of hLXRα to both saturated and unsaturated FA. However, there is a preference for binding medium chain fatty acids as compared to short chain and long chain fatty acids. Additionally, activity assays suggest that FA increases the expression of hLXRα target genes when hLXRα is overexpressed. Docking studies using the reported crystal structure of the ligand binding domain of hLXRα confirm that medium chain FA and FA-CoA can bind to the ligand binding domain of hLXRα with favorable binding energies. This data suggests a role of these nutrients in the activation of hLXRα and modulation of lipid and cholesterol metabolism.

Co-Authors/Collaborators: Genesis V. Hines, Alagammai Kaliappan, S. Dean Rider Jr., Ph.D., and Heather A. Hostetler, Ph.D.

ΔNp63α Repress Nuclear Translocation of PTEN by Inhibition of NEDD4-1 in Keratinocytes

Student Presenter(s): Natasha Hill, Graduate Student in Biomedical Sciences
FACULTY MENTOR: MADHAVI KADAKIA, PH.D.
DEPARTMENT: BIOCHEMISTRY & MOLECULAR BIOLOGY

ΔNp63α maintains the proliferative potential of keratinocytes by inhibiting the transcription and nuclear localization of the tumor suppressor PTEN as shown earlier by our laboratory. The goal of this study was to define the mechanisms by which ΔNp63α mediates the nuclear exclusion of PTEN. The effect of ΔNp63α on PTEN ubiquitination was measure via ubiquitin assay following overexpression of ΔNp63α in H1299 cells. We demonstrate that ΔNp63α reduces the ubiquitination of PTEN, a key signaling event in the nuclear translocation of PTEN. To determine how ΔNp63α regulate PTEN ubiquitination we examined the expression of NEDD4-1, an E3 ubiquitin ligase. The decrease in ubiquitinated PTEN correlated with the ability of ΔNp63α to bind to NEDD4 promoter and transcriptionally repress the E3 ubiquitin ligase NEDD4-1. Knockdown of NEDD4-1 in cultured keratinocytes was sufficient to attenuate the increase in nuclear PTEN observed upon silencing of ΔNp63α. In vivo examination of normal skin demonstrated that ΔNp63α and NEDD4-1 were both expressed in the basal layer of the epidermis and this correlated with nuclear exclusion of PTEN. Altogether, these studies suggest that ΔNp63α-mediated suppression of nuclear PTEN in basal layer keratinocytes occurs through repression of NEDD4-1 expression.

Co-Authors/Collaborators: Mary K. Leonard, Ethan D. Grant, and Madhavi P. Kadakia, Ph.D.

Western Blotting and its Applications to the Study of the Signaling Pathway of the DNA Replication Checkpoint in Fission Yeast

And

Western Blotting and Its Application to the Study of DNA Replication Checkpoints

Student Presenter(s): Robert Johnson, Undergraduate Student in Chemistry
FACULTY MENTOR: YONG-JIE XU, PH.D.
DEPARTMENT: BIOCHEMISTRY & MOLECULAR BIOLOGY

Western blotting analysis is a common technique used in biology laboratories and a powerful tool for the study of cell signaling pathways. This analysis employs antibodies to detect proteins of interest as well as protein modifications. Full analysis of Western blotting is performed through the following steps: (1) Sample preparation, (2) Separation by electrophoresis, (3) Transfer sample to a membrane, (4) Blocking for membrane specification, and (5) Detection using antibodies. The primary antibody recognizes the specific protein on the membrane. The secondary antibody linked with a reporter enzyme binds to the primary antibody bound on the membrane and allows amplification of the signal and thus detection of the protein of interest. The focus of our lab was the study of the DNA replication checkpoint using the fission yeast Schizosaccharomyces pombe as the model organism. The replication checkpoint is a signaling pathway involving a phosphorylation cascade along various checkpoint proteins called the sensors, the mediators, and the effectors. One critical step in the signaling pathway is the phosphorylation of the mediator protein Mrc1 (Claspin in humans) by the sensor kinase Rad3 (ATR in humans) at two redundant sites T645 and T653 in the middle of the protein. Phosphorylation of Mrc1 plays an essential role in recruiting the effector kinase Cds1 (Chk2 in humans) for its phosphorylation by Rad3. We used the

Western blotting method to study the phosphorylation of Mrc1 by Rad3 and its function in signaling to Cds1 under various replication stresses. Proteins and their covalent modifications can be easily detected by Western blotting that makes the technique a powerful tool in analyzing biology systems. Our analysis of Mrc1 phosphorylation is an example of usefulness of this method, and as such, this technique will remain a vital tool in future studies of other signaling pathways in the cell.
Co-Authors/Collaborators: Yong-Jie Xu, Ph.D., and Amanpreet Singh

Endogenous Ligand Binding Profile of Full-Length Human PPAR Alpha in Comparison to Murine PPAR Alpha

Student Presenter(s): Dhawal Oswal, Graduate Student in Biomedical Sciences
FACULTY MENTOR: HEATHER A. HOSTETLER, PH.D.
DEPARTMENT: BIOCHEMISTRY & MOLECULAR BIOLOGY

Peroxisome proliferator-activated receptor alpha (PPARα) belongs to the family of ligand dependent nuclear transcription factors that play key roles in regulating lipid homeostasis. Previous studies using truncated or tagged recombinant mouse and xenopous PPARα have suggested that they serve as sensors of fatty acids (FA) and their thioester derivatives (fatty acyl coenzyme A; FA-CoA). However, no such studies have been conducted with full-length human PPARα (hPPARα). Owing to differences in the physiological effects of PPARα activation across species (peroxisome proliferation seen in rodents but not in humans), it is possible that binding affinities and specificities for such ligands may differ. As endogenous ligands, dysregulated FA and FA-CoA may alter the transcriptional activity of PPARα and may contribute to the pathogenesis of the metabolic syndrome. In the current study, we test the binding of various FA and FA-CoA to full-length hPPARα and mPPARα. Data from both spectrofluorometry and circular dichroism spectroscopy suggest binding of both saturated and unsaturated FA and FA-CoA to hPPARα at physiologically relevant cellular concentrations. This was in contrast to binding studies conducted with murine PPARα, which bound to only unsaturated FA but not saturated FA. Such differences in ligand binding could be a result of structural differences in the protein across species. We took advantage of methodologies including, molecular modeling and in silico docking, mutagenesis to identify amino acid residues responsible for such divergence. Modeling suggested that specific amino acid substitution at 272 is likely responsible for species differences in saturated LCFA binding to human and mouse PPARα. These results have helped determine and differentiate endogenous ligands for human and murine PPARα and will further help delineate the role PPARα as a nutrient sensor in regulating energy homeostasis.
This work was supported in part by USPHS NIH grant DK77573 and funds from the Boonshoft School of Medicine.
Co-Authors/Collaborators: Madhumitha Balanarasimha, Alagammai Kalippan, S. Dean Rider Jr., Ph.D., and Heather Hostetler, Ph.D.

Biological Sciences

Apical Coxsackievirus and Adenovirus Receptor (CAR) Expression is Highly Regulated in Polarized Cells

Student Presenter(s): Mahmoud Alghamri, Graduate Student in Biomedical Sciences

FACULTY MENTOR: KATHERINE EXCOFFON, PH.D.
DEPARTMENT: BIOLOGICAL SCIENCES

The coxsackievirus and adenovirus receptor (CAR) acts as a primary receptor for its two namesake pathogenic viruses. We have previously shown in polarized epithelia that a low-abundance, alternatively spliced eight-exon isoform of CAR, CAREx8, can localize at the air-exposed apical surface and support apical adenoviral infection. In order to study the molecular basis of CAREx8 stability and localization in polarized cells, Madin-Darby canine kidney (MDCK) epithelial cell lines stably expressing doxycycline (dox)-inducible FLAG-tagged human CAREx8 or red fluorescence protein (RFP) were developed using the lentivirus-based pLVX-Tight-Puro system (Clontech). The MDCK cell line was chosen since it is a major model system for epithelial polarization and protein trafficking. In the absence of dox, each inducible-cell line was matched with parental MDCK cells for a number of polarization parameters and no exogenous CAREx8 or RFP was detected by Western blot or immunocytochemistry. Induction of CAREx8 or RFP was dose dependent. Interestingly, apical surface-selective biotinylation of CAREx8 demonstrated a plateau of apical CAREx8 protein above ~100 ng/ml dox and correlated directly with a plateau in apical adenovirus entry and transduction. Protein turnover studies by Western blot analysis indicate a short half-life of 3.6 h for cytosolic CAREx8. However, CAREx8 at the apical surface showed a slightly longer half-life , 4.6 h. Overall, these data suggest that there may be a limit to CAREx8 production, stability, or usage at the apical surface. Moreover these cell lines provide an outstanding model system to investigate the molecular regulation of the apical adenovirus receptor.

Co-Authors/Collaborators: Trisha Brockman, Poornima Kotha Lakshmi Narayan, Ran Yan, Abimbola Kolawole, Priyanka Sharma, Ph.D., and Katherine Excoffon, Ph.D.

Accurate Splicing of HDAC6 Transcripts Requires Son

Student Presenter(s): Vishnu Priya Chowdary Battini, Graduate Student in Biological Sciences

FACULTY MENTOR: PAULA BUBULYA, PH.D.
DEPARTMENT: BIOLOGICAL SCIENCES

Pre-mRNA splicing requires proper splice site selection mediated by many factors including snRNPs and serine-arginine rich (SR) splicing factors. Son is the largest known SR splicing factor, and it has several putative functional domains including an RS domain, a glycine rich patch (G-patch) and double stranded RNA binding domain (DSRBD). One-third of Son's amino acid sequence consists of novel repetitive sequence motifs of unknown function. Son is essential for organization of pre-mRNA processing factors in nuclear speckles and for cell cycle progression. We previously reported an exon array analysis of Son-depleted HeLa cells that revealed changes in 1061 transcripts showing exon inclusion or exclusion, and a total of 2067 splicing events that are potentially regulated by Son. We validated that Son is required for appropriate splice site choice in transcripts for several chromatin-modifying enzymes, including HDAC6, ADA and SETD8. However, the mechanism by which Son maintains accurate splicing is unknown. We are systematically generating model minigene cassettes for molecular and in situ analysis of Son-dependent splicing regulation. We have constructed a HDAC6 minigene reporter that contains the genomic sequence spanning

exons 26 through 29. Following Son depletion in HeLa cells transfected with the HDAC6 minigene reporter construct, we observed skipping of exons 27 and 28 on both the reporter and endogenous HDAC6 transcripts. We hypothesize that the C-terminal RS domain of Son is required to maintain proper splicing of HDAC6 transcripts, and we are evaluating siRNA-refractory Son deletion mutants to determine which domains of Son can rescue splicing of HDAC6 minigene transcripts.
Co-Authors/Collaborators: Athanasios Bubublya, Ph.D. and Paula Bubulya, Ph.D.

TALEN-Based Genome Editing to Knock Out the Apical Isoform of the Coxsackievirus and Adenovirus Receptor and Block Apical Adenovirus Entry into Polarized Epithelia

Student Presenter(s): Jonathan Bowers, Undergraduate Student in Biological Sciences

FACULTY MENTOR: KATHERINE EXCOFFON, PH.D.
DEPARTMENT: BIOLOGICAL SCIENCES

Adenoviruses mediate a large number of upper respiratory infections each year; adenovirus has also been extensively studied as a potential vector for gene therapy. To initiate infection, most adenovirus serotypes utilize the coxsackievirus and adenovirus receptor (CAR) as a primary cellular receptor. One isoform of CAR, CAREx8, has been found to localize to the apical surface of polarized cells where it can mediate viral entry from the air-exposed surface. We hypothesize that CAREx8 is required for apical adenovirus infection; we propose that by knocking out CAREx8 at the gene level, adenovirus will lack its primary receptor and viral transduction will not occur from the apical surface. To knock out CAREx8, transcription activator-like effector nucleases (TALENs) targeted to nucleotide sequences upstream and downstream of exon 8 were cloned into plasmids. TALEN activity was validated by Surveyor assay and transfection in HEK-293 cells demonstrated introducing a variety of mutations within the 8th exon of CAR. In order to select of a pure population of knockout cells, a donor plasmid was constructed containing a mutated copy of the 8th exon of CAR with an internal SNAP-tag, to both silence the 8th exon and to identify transfected cells. Future work will focus on creating a CAREx8-knock out Calu-3 airway cell line and investigate apical adenoviral transduction to determine whether CAREx8 is the major apical adenovirus receptor. Understanding the mechanism of adenovirus entry will allow the development of novel methods to decrease pathogenic infection or increase the efficiency of gene therapy.
Co-Authors/Collaborators: Priyanka Sharma, Ph.D., TJ Cradick, Gang Bao, and Katherine Excoffon, Ph.D.

Src-Family Kinases do not Affect Apical Expression of the Coxsackie and Adenovirus Receptor in Polarized Epithelial Cells

Student Presenter(s): Trisha Brockman, Graduate Student in Biological Sciences

FACULTY MENTOR: KATHERINE EXCOFFON, PH.D.
DEPARTMENT: BIOLOGICAL SCIENCES

Adenoviruses are significant respiratory pathogens that threaten both civilian and military populations. Adenovirus infection is dependent on viral receptor abundance and accessibility. Although the majority of its primary receptor, the Coxsackievirus and Adenovirus Receptor (CAR), localizes to the basolateral surface of polarized epithelial cells, we have recently shown that a low abundance eight-exon isoform of CAR (CAREx8) can localize to the apical surface where it is able to mediate viral infection. Recent studies show that the Src-family kinase inhibitor PP2 can diminish both adenovirus and reovirus infection. We hypothesized that Src-family kinases alter adenoviral entry by regulating the apical expression of CAREx8. To test this hypothesis, CAREx8 expression and localization, along with adenovirus entry and transduction, were analyzed in polarized model lung epithelial cells (CaLu-3) treated

with PP2. In contrast to decreased adenovirus infection, increasing the time and dose of PP2 treatment of CaLu-3 cells did not alter total or apical surface-specific CAREx8 expression. We next asked which Src-family kinase was responsible for decreased adenovirus infection. Silencing c-Src in Hela cells using a short hairpin RNA (shRNA) showed a significant decrease in viral transduction. These findings implicate that c-Src kinase is crucial for efficient viral infection but not CAR expression. c-Src kinase may regulate the molecular trafficking of internalized virions after adenovirus entry. This study lays a foundation for the development of novel therapeutics to mitigate adenovirus infection in susceptible populations.

Co-Authors/Collaborators: Priyanka Sharma, Ph.D., Poornima Kotha Lakshmi Narayan, and Katherine Excoffon, Ph.D.

Expression and Function of Genes Involved in Spermatogenesis in the Planarian *Schmidtea mediterranea*

Student Presenter(s): Tasha Hester, Graduate Student in Biological Sciences

FACULTY MENTOR: LABIB ROUHANA, PH.D.

DEPARTMENT: BIOLOGICAL SCIENCES

Characterizing the molecular events that ensure proper spermatogenesis is key for understanding illnesses of the male reproductive system. Because of their ability to regenerate all somatic and reproductive tissue, planarians serve as great models to study stem cell biology and germline development. Preliminary data identified a homolog of the human Cytoplasmic Polyadenylation Element Binding Protein 2 (CPEB2) in the planarian Schmidtea mediterranea, which is expressed in the testes and brain. A decrease in CPEB2 function after RNA-interference (RNAi) resulted in underdeveloped testes and loss of sperm. This phenotype allowed for comparison between genes expressed in control planarians (with normal spermatogenesis) and CPEB2(RNAi) planarians (void of sperm and sperm cell precursors). Transcriptomic analyses revealed decreased expression for hundreds of genes in CPEB2(RNAi) planarians. These genes are hypothesized to be expressed in testes and function in spermatogenesis. Further analysis is being pursued for 23 evolutionarily conserved genes based on larger decrease in expression after CPEB2 RNAi, as well as potential functions in transcription, sperm motility and/or sperm structure. The aim of this project is to determine the expression and function in 23 of these candidate genes during spermatogenesis. Whole mount in-situ hybridization will be executed to determine where these genes are expressed throughout the planarian anatomy. RNAi will be performed to disrupt the function of these candidate genes and assess phenotypic changes in testes and sperm development. Defining how these factors are involved in spermatogenesis will influence translational research applicable to human and veterinary reproductive health.

Transduction of Adipose Derived Stem Cells with Adeno-Associated Virus

Student Presenter(s): Shon Jergens, Undergraduate Student in Clinical Laboratory Science

FACULTY MENTOR: KATHERINE EXCOFFON, PH.D.

DEPARTMENT: BIOLOGICAL SCIENCES

Adipose-derived stromal cells (ADSCs) are ideal candidates to serve as autologous transgenic drug delivery devices in burn patients due to their ability to survive in ischemic settings, low morbidity of isolation, and ability to differentiate into multiple cell lineages. Enhancing the capacity of ADSCs to secrete a variety of proteins able to accelerate wound healing could potentially allow for a better recovery for these patients. We hypothesize that the clinically approved, nonpathogenic adeno-associated virus (AAV) vector will provide an efficient and safe method to effectively deliver therapeutic genes into ADSCs. ADSCs were extracted and purified from healthy human donors. The ADSCs were transduced with serotypes AAV1, AAV2, AAV4, AAV5, AAV8, and

AAV9 carrying the green fluorescent protein (GFP) gene. Multiplicity of infection of 10e4 and 10e6 viral genomes/cell was used and non-transduced ADSCs served as controls. Quantification of fluorescence levels under microscopy was used to determine the efficacy of transduction. GFP expression occurred in ADSCs with AAV5, AAV8, and AAV9, signifying successful transduction. AAV1, AAV2, and AAV4 displayed few to no GFP-positive cells. AAV serotype 5 was shown to have the greatest infectivity, with GFP expression lasting throughout the 10 day experiment. Cells transduced with AAV8 and AAV9 showed GFP expression only through 48 hours. In summary, AAV5 exhibited the greatest capacity to transduce ADSCs. Future work will investigate AAV5-based transduction and expression of the first candidate, vascular endothelial growth factor, in ADSCs.

Co-Authors/Collaborators: Priyanka Sharma, Ph.D., Gregory Gould, Sunishka Wimalawansa, M.D., Michael Johnson and Katherine Excoffon, Ph.D.

On the Specialization of Tooth Morphology in Early Cladodont Sharks

Student Presenter(s): Madelyn Jones, Undergraduate Student in Biological Sciences

FACULTY MENTOR: STEPHEN JACQUEMIN, PH.D.
DEPARTMENT: BIOLOGICAL SCIENCES

Differentiation of tooth shape with jaw position is a well-known pattern in modern piscivorous sharks. This pattern has a functional linkage in both feeding performance and dietary diversity. However, whether specialization of tooth shape was present in early sharks is not known. The objective of this study was to describe tooth shape in early Devonian cladodont sharks, Ctenacanthus and Cladoselache, and test for tooth shape specialization with jaw position. Geometric morphometrics was used to describe tooth shape and resulting axes were regressed with jaw position to test for differentiation with position. Tooth shape did not significantly covary with jaw position in cladodont taxa, however, significant morphometric differences between Ctenacanthus and Cladoselache were evident. Inclusion of two modern taxa with similar niches as the cladodont taxa yielded predictable differentiation of tooth shape with jaw position. The degree of overlap in shape ordination between Ctenacanthus and Cladoselache tooth morphologies may have additional ramifications for positive identification of loose teeth in other paleo work and warrants additional morphometric study.

Co-Authors/Collaborators: Stephen Jacquemin, Ph.D., Chuck Ciampaglio, Ph.D., Zach Whetstone, and David Cicimurri

Adeno-Associated Virus Transduction of Human CD4+T Lymphocytes

Student Presenter(s): Sahar Kamel, Graduate Student in Microbiology and Immunology

FACULTY MENTOR: KATHERINE EXCOFFON, PH.D.
DEPARTMENT: BIOLOGICAL SCIENCES

Development of latent HIV-infected CD4+T lymphocytes is the major cause of HIV treatment failure. Adeno-associated virus (AAV) is an attractive vector for anti-HIV gene therapy due to its lack of pathogenicity, low immunogenicity, and persistent transgene expression. However, a major limitation for AAV gene transfer is the cell-specific tropism of each serotype. Only serotypes 2 and 5 have been investigated in hematopoietic cells, both of which show low transduction efficiency. We hypothesized that other serotypes may demonstrate improved transduction over AAV2 or 5. To test this we used both H9 (T-cell line) and primary CD4+-T lymphocytes that were isolated from peripheral blood mononucleated cells (PBMCs) of healthy donors using ficoll gradient. CD4+T lymphocytes were enriched by negative selection using EasysepTM Enrichment Cocktail (Stemcell Tech.); ~96% of the cells were CD4+ T lymphocytes after staining with FITC labeled anti-CD4 using flow cytometry. Both H9 cells and CD4+-T lymphocytes were

infected with various rAAV serotypes encoding the gene for GFP at various MOI. Amongst the different serotypes tested, while rAAV5 had the greatest transduction efficiency in H9 cells, rAAV9 was the best in CD4+-T lymphocytes at MOI 106, as determined by fluorescence microscopy and flow cytometry. Although none of the AAV serotypes investigated demonstrated transduction efficiency sufficient to achieve a clinically relevant therapeutic index, other serotypes or novel methods to modify tropism may yield vectors suitable for gene delivery in disease-associated leukocytes.
Co-Authors/Collaborators: Poornima Kotha Lakshmi Narayan, Dawn Wooley, Ph.D., and Katherine Excoffon, Ph.D.

Analysis of Switchgrass and Corn Stover Hydrolysate Fermentations for Feedstock Comparison

Student Presenter(s): Grace Klinger, Undergraduate Student in Biological Sciences
FACULTY MENTOR: YAOPING ZHANG, PH.D. GLBRC (UNIVERSITY OF WISCONSIN – MADISON) AND GERALD ALTER, PH.D. (WRIGHT STATE UNIVERSITY)
DEPARTMENT: BIOLOGICAL SCIENCES

Corn stover, used as a feedstock in hydrolysis and fermentation to produce ethanol, is currently used to produce hydrolysates containing 6% glucose and 3% xylose1. The compositional analysis of switchgrass and corn stover has elucidated a disparity between their respective compositions. This study demonstrates the comparison between the two feedstocks' respective hydrolysate and their fermentation performance. This is done using a trial of test switchgrass hydrolysate batches to obtain comparable levels of glucose and xylose such as that found in corn stover hydrolysate (ACSH). Enzyme ratios were assessed and the enzyme solution CTec2 was increased by 1.5 times the ratio used for corn stover. Acid added to control the pH at 5.3 for the enzymes to function optimally was also increased from the normal corn stover Standard Operating Procedure (SOP)1. After sugar levels in switchgrass hydrolysate were found to be somewhat comparable to ACSH, side-by-side fermentations of the two feedstocks using Escherichia coli and Saccharomyces cerevisiae in microaerobic conditions were performed. Time points of optical density (OD), YSI to measure real-time glucose and xylose levels, and HPLC-RID endproduct data were used to assess that switchgrass could not use the standard corn stover hydrolysate SOP1 and instead the SOP had to be adjusted and will continue to be further adjusted to increase glucose and xylose levels to match that found in ACSH. Switchgrass fermentation data of sugar utilization and ethanol production indicate a trend comparable to corn stover despite the lower initial glucose levels. This can be further studied to show how similar sugar utilization is when switchgrass hydrolysate batch sugar content matches that of corn stover.
Co-Authors/Collaborators: Alex La Reau, Haibo Li, and Yaoping Zhang, Ph.D.

The Coxsackievirus and Adenovirus Receptor (CAR) Mediates Neutrophil Adhesion on the Epithelial Cell Surface.

Student Presenter(s): Poornima Kotha Lakshmi Narayan, Graduate Student in Microbiology and Immunology
FACULTY MENTOR: KATHERINE EXCOFFON, PH.D.
DEPARTMENT: BIOLOGICAL SCIENCES

CAR is the primary receptor for adenovirus entry and infection. As a result of alternative splicing, two transmembrane isoforms of CAR are generated. The most predominant isoform, CAREx7 localizes at the basolateral surface of the polarized epithelial cells where it is important for the maintenance of the epithelial barrier integrity and neutrophil transmigration. In contrast, CAREx8 localizes at the sub-apical and apical regions of polarized epithelial cells and its endogenous function is unknown. We hypothesized that CAREx8 mediates neutrophil adhesion on the apical surface of epithelial cells within an epithelium. Localization of neutrophils in the region of inflammation via cell-cell adhesion would

facilitate microbial clearance from the airway without broadly affecting the epithelium. To address this, we developed epithelial MDCK cell lines stably expressing CAREx7, CAREx8, or m-Cherry, tightly regulated under a doxycycline-inducible promoter. After doxycycline-mediated gene expression, a neutrophil adhesion assay was performed using primary neutrophils obtained from the peripheral blood of healthy human donors. Neutrophil binding to the apical surface of polarized MDCK cells increased significantly on the CAREx8, but not CAREx7 or control mCherry epithelia. Likewise, CAREx8 also mediated adhesion of infiltrating neutrophils at the apical surface. Finally, interleukin-8 (IL-8), a neutrophil chemoattractant, increases endogenous CAREx8 expression on the apical epithelial cell surface. Taken together, these data suggest a novel regulatory circuit for inflammation and microbial clearance by neutrophils. Thus, CAREx8 is a novel target for modulating inflammatory responses.

Co-Author/Collaborator: Katherine Excoffon, Ph.D.

Host Plant Limitations in Two Species of Andean Altinote Butterflies

Student Presenter(s): Karen Pedersen, Graduate Student in Biological Sciences
FACULTY MENTOR: JOHN STIREMAN, PH.D.
DEPARTMENT: BIOLOGICAL SCIENCES

Background

Over half of all described species participate in plant-insect interactions. We expect plant feeding insects to eat a large number of plants because this would allow for a large geographic range and a lager populations size. However contrary to expectations plant-feeding insects eat a small number of the available plants. There are a number of hypotheses explaining why most plant feeding insects feed on a small number of available plants. Adaptations for the physical and chemical defenses on one plant species may reduce fitness on other plants. Alternatively, adaptations to avoid enemies may limit food-plant use. We studied food-plant use of Altinote dicaeus and A. stratonice butterflies at the Yanayacu Biological Station in the Ecuadorian Andes. A. dicaeus and A. stratonice are closely related co-occurring species, with overlapping food-plants.

Predictions

1) Caterpillars should have higher rates of survival on preferred food-plants. 2) Pupal masses should be higher on preferred food-plants. 3) The rate of parasitism should be lower on preferred food-plants.

Methods

Experiment 1

Caterpillars were collected from the field and reared on the plant species they were found on in the field. Each caterpillar or group of caterpillars was counted as one encounter. Pupa were weighed and an average mass obtained for each plant. The rate of parasitism was calculated for each caterpillar species on their food-plants.

Experiment 2

Groups of caterpillars were collected and placed on the three of the plants of interest. Dates of death were used to create a Kaplan–Meier curves.

Results

1) A.dicaeus and A. stratonice prefer different food-plants, 2) Caterpillar survival is not higher on the preferred food-plant. 3) The pupal mass is not higher on the preferred food-plant. The rate of parasitism is not lower on the preferred food-plant.

Conclusions

Neither host plant quality nor rate of parasitism explains food-plant limitation in Altinote butterflies. Further research into the abundance of food-plants and the rates of predations on different food-plants may explain food-plant use in Altinote butterflies.

Co-Author/Collaborator: John Stireman, Ph.D.

Interaction of Son with a Heterochromatic Transgene Array

Student Presenter(s): Jennifer Pence, Graduate Student in Biological Sciences
FACULTY MENTOR: PAULA BUBULYA, PH.D.
DEPARTMENT: BIOLOGICAL SCIENCES

The nuclear speckle splicing factor called Son has within its sequence a cluster of unique tandem repeats as well as an arginine-serine-rich (RS) domain, a G-patch and a double-stranded RNA binding domain at its C-terminus. Son's unique repeats are required for proper nuclear speckle organization, and other domains are important for splicing regulation for a subset of human mRNAs. To investigate Son's activities at transcription sites in situ, we used the U2OS 2-6-3 cell line containing an integrated transgene array that allows visualization of gene expression at a specific site of chromosome 1. Our lab discovered that unlike other SR proteins that are recruited to this reporter array after transcriptional activation, Son localizes to the inactive reporter gene locus and is absent following transcription induction. Immunofluorescence analysis shows that upon transcriptional activation, enrichment of Son at the U2OS 2-6-3 locus decreases within thirty minutes and leaves the locus within sixty minutes. Chromatin immunoprecipitation with anti-Son antibodies (Son-ChIP) indicates that Son enrichment is highest at the promoter region of the U2OS 2-6-3 transgene array. We hypothesize that Son maintains the heterochromatic state of the inactive reporter array, and that Son may be needed during the first steps of gene activation to recruit components required for mRNA synthesis and/or processing. Heterochromatin maintenance would be a novel role in gene expression for a splicing factor. Experiments to determine Son's specific role in gene expression at this locus as well as endogenous human gene loci are being pursued.

Co-Authors/Collaborators: Alok Sharma, and Paula Bubulya, Ph.D.

Male Specific Lethality in F1 Hybrids of Caenorhabditis

Student Presenter(s): Valshnavi Ragavapuram, Graduate Student in Biological Sciences, and Scott Baird, Ph.D.

FACULTY MENTOR: SCOTT BAIRD, PH.D.
DEPARTMENT: BIOLOGICAL SCIENCES

When Caenorhabditis briggsae males are mated to C. sp. 9 females, fertile F1 females and sterile F1 males are obtained. From the reciprocal cross, fertile F1 females still are obtained but all F1 males die during embryogenesis. The difference in F1 male viability between these crosses may be due to difference in mitochondrial cytotype, the source of maternal mRNAs and proteins or the source of the single X chromosome in hybrid males. The goal of this research was to distinguish between these possible causes of F1 male lethality. To accomplish this, two crosses were conducted using C.sp.9, C.briggsae, and cybrids. C. briggsae males were crossed with cybrids that contained C.briggsae mitochondria and C.sp.9 nuclear genome. The F1 males were obtained, which suggests that mitochondrial cytotype is not the cause of male lethality. C.sp.9 males were crossed with C. briggsae hermaphrodites which was a mutant strain that exhibited high levels of X-chromosome nondisjunction. From this cross, exceptional males that possessed a paternal rather than maternal X-chromosome were expected to be present. Viable F1 males were obtained from this cross indicating that lethality is caused by the C. briggsae X-chromosome.

White-Tailed Deer Alter Spider Communities through Direct and Indirect Mechanisms

Student Presenter(s): Elizabeth Sancomb, Graduate Student in Biological Sciences

FACULTY MENTOR: THOMAS P. ROONEY, PH.D.
DEPARTMENT: BIOLOGICAL SCIENCES

White-tailed deer populations in North America have increased greatly since pre-colonial times, reaching and maintaining densities above 10/km2 throughout temperate zones. Deer directly impact vegetation structure and species composition through selective foraging. This can lead to indirect impacts on other forest species through alterations in habitat, food-web interactions, and microclimate. Deer have been implicated as a driver of species losses and reduced vegetation structure of plant communities in northern Wisconsin, because of their selective feeding on broad-leafed species. Few researchers have examined how vegetation changes are affecting arthropod communities. I examined the effects of deer exclusion on web-building spider communities in a hemlock-northern hardwood stand in northern Wisconsin. I measured spider abundance as well as web-site availability (WSA) and litter depth using a nested block design. Overall spider abundance was 54% higher in exclosures ($P < 0.01$) and rarefaction analysis revealed that exclosures reach maximum family richness with 45% fewer sampled individuals (33 compared to 73 individuals). Spider community composition may differ between exclosures and controls ($P = 0.057$). WSA at both 0.5m and 1.0m was higher in exclosures (7-fold, $P < 0.001$; 48-fold, $P < 0.05$), as was leaf litter depth (52%, $P < 0.01$). Abundance increased with WSA at 0.5m at the treatment level ($P < 0.01$) and with litter depth at the variable level ($P < 0.01$), whereas family richness significantly increased with WSA at 1.0m and litter depth at the variable level ($P < 0.05$; $P < 0.001$). These findings indicate white-tailed deer are driving changes in spider communities through direct and indirect mechanisms.

Co-Author/Collaborator: Thomas P. Rooney, Ph.D.

Inhibition of a Hyperpolarization-Activated Inward Current (Ih) Facilitates Cold-Activation of Locus Coeruleus Neurons of Bullfrogs, Lithobates Catesbeianus

Student Presenter(s): Joseph Santin, Graduate Student in Biomedical Sciences

FACULTY MENTOR: LYNN HARTZLER, PH.D.
DEPARTMENT: BIOLOGICAL SCIENCES

Mechanisms that determine neuronal excitability under variable temperatures are unclear. In bullfrogs, cooling increases action potential (AP) firing in locus coeruleus (LC) neurons. We used whole-cell patch clamp electrophysiology in brainstem slices to test whether inhibition of a hyperpolarization-activated current (Ih) promotes increases in LC neuron excitability during cooling from 20°C to 10°C. Cooling reduced maximum Ih amplitude from -211.5±55.0pA to -69.5±7.8pA ($P<0.05$) and shifted the voltage at half maximal activation (V50) from -69.9±11.4mV to -92.9±5.8mV ($P<0.05$). Application of 2mM CsCl inhibited Ih (-142.8±53.3pA vs. -3.3±14.3pA; $P<0.05$), and may potentiate AP firing increases induced by cooling (increase in AP firing; control: 0.9±0.5Hz vs. Cs+: 2.2±1.6Hz; $P=0.2$; $n=3$). Elevating intracellular cyclic AMP to 100μM increased the proportion of activated Ih near resting membrane potential (Vm) at 20°C and 10°C (V50 =-63.7±9.5mV and -71.3±10.2mV); yet, activation of Ih suppressed the firing increase elicited by cooling (0.2±0.7Hz decrease vs. increased firing in controls; $P=0.06$; $n=5$). Our data suggest inhibition of Ih enhances LC excitability during cooling and implicate Ih as a temperature-sensitive mechanism that modulates neuronal excitability during changes in brain temperature. Given extensive involvement of LC neurons in physiological functions, understanding the regulation of LC neuron excitability during temperature changes has broad ramifications.

Co-Author/Collaborator: Lynn Hartzler, Ph.D.

Effects of Hypoxia and Hypercapnia on Cambarus Bartonni Cavatus

Student Presenter(s): Lauren Shafer, Undergraduate Student in Biological Sciences
FACULTY MENTOR: LYNN HARTZLER, PH.D.
DEPARTMENT: BIOLOGICAL SCIENCES

The Appalachian Brook crayfish, Cambarus bartonii cavatus, lives in an ever changing environment. Crayfish are used as model organisms in many applications because there is a diversity of species found in restricted geographical regions and are prevalent in freshwater environments (Crandall, 2006). Water composition is subject to change as a result of factors such as rainfall, agricultural runoff, and eutrophication leading to decreased oxygen levels. Crayfish are frequently found in areas of hypoxic water (Bonvillain et al., 2012), but the crayfish are not necessarily tolerant to chronic hypoxia. This can lead to a loss of species from an area (Lyons and Kelly-Quinn, 2003), and is a strong indicator that there may be a water quality problems in the environment. Similarly, increased Pco2 may lead to behavioral modification. Acidification of large bodies of water due to anthropogenic increases in CO2 is affecting crustaceans' ability to form hard exoskeletons. Their ability to sense environmental CO2 is important to be able to detect stressful levels of CO2, and to potentially take behavioral actions to avoid CO2/pH. In our experiments, we measured behavioral choice across hypoxic and hypercapnic gradients. As dissolved oxygen levels decreased, crayfish did not move as far and decreased their velocity; however, they spent more time in low oxygen. There were no significant behavioral changes in response to hypercapnia, even as high as 5% CO2. We conclude that over the short term (hours), Cambarus bartonii cavatus are either insensitive to or are tolerant to hypoxia and hypercapnia. It remains possible that Cambarus bartonii cavatus are intolerant to hypoxia and hypercapnia over the long term (days to weeks); however, this remains to be tested.

Co-Author/Collaborator: Lynn Hartzler, Ph.D.

Wnt/β–Catenin Signaling Modulates Coxsackievirus and Adenovirus Receptor (CAR) Expression and Adenoviral Infectivity in Human Airway Epithelial Cells.

Student Presenter(s): Priyanka Sharma, Ph.D., Graduate Student in Microbiology and Immunology
FACULTY MENTOR: KATHERINE EXCOFFON, PH.D.
DEPARTMENT: BIOLOGICAL SCIENCES

The CXADR gene is located at human chromosome 21 and codes for the coxsackievirus and adenovirus receptor (CAR). CAR is localized at the apicolateral/basolateral surface of polarized human airway epithelial cells (HAE) and is a component of tight junctions. CAR was initially identified as a primary viral receptor for two distinct group of viruses (coxsackievirus and adenovirus). CAR expression levels are likely the most important determining factor for the efficacy of adenovirus-based gene therapy. Our understanding of how to manipulate CAR expression levels remains incomplete. Previously we have shown that inhibition of glycogen synthase kinase 3β (GSK3β) results in increased CAR expression. However the exact mechanism was unclear. We hypothesized that GSK3β regulates the amount of CAR through the Wnt/β–catenin signaling pathway. Treatment of HAE with GSK3β inhibitor resulted in an increase in CAR, β–catenin, and TAZ expression by qRT-PCR, immunocytochemistry and Western blot, and correlated with increased apical adenovirus transduction. A new physical association between CAR, β–catenin and TAZ was verified by coimmunoprecipitation. β-catenin was also redistributed from the cytoplasm to the nucleus. Treatment of HAE with GSK3β agonist reduced CAR expression and adenoviral transduction. Moreover, transfection of CHO cells with constitutively active β–catenin results in increased CAR expression and downstream targets of Wnt pathway, demonstrating that CAR is

regulated by the Wnt/β–catenin pathway. Dissecting the biological pathways that regulate CAR expression could set a platform for new pharmacological interventions focusing achievement of high cell surface CAR levels to maximize clinical adenoviral vector uptake.
Co-Authors/Collaborators: James Readler and Katherine Excoffon, Ph.D.

Tooth Morphology Provides Evidence of ancestral Megalodon Shark Linage

Student Presenter(s): Suzanna Wlnt, Undergraduate Student in Earth and Envioronmental Sciences
FACULTY MENTOR: STEPHEN JACQUEMIN, PH.D., AND CHUCK CIAMPAGLIO, PH.D.
DEPARTMENT: BIOLOGICAL SCIENCES

The phenetic relationships within the mega-toothed shark evolutionary lineage that culminates in C. megalodon are unclear. Previously noted patterns between several predominant taxa have elicited numerous hypotheses, however, few analytical approaches have been applied to test the relationships therein. Geometric morphometrics was used to describe overall tooth shape of upper anterior and lateral jaw of the extinct mega-toothed sharks and the resulting axes were combined in an ordination analysis to indicate phenetic relationships among taxa. In addition, density of serrations and variability in serration spacing / height were regressed on shape by species to further describe nominal taxa. The primary morphological gradients retrieved included fine distinctions between individuals based on root lobe and bourlette width as well as blade and cusplet width. Taxa classified as C. appendiculata, O. obliquus, C. aksuaticus, C. auriculatus, C. sokolovi, C. anguistidens, C. chubatensis, and C. megalodon tended to exhibit increasingly wide blade and root widths with an increasingly reduced cusplet presence, respectively. This taxa gradation was also typified by the appearance of serrations, increase in serration density, and decrease in serration variation. Overall, the results from the lateral and anterior tooth shape analyses support the current delineation of some taxa and suggest synonymizing others.
Co-Authors/Collaborators: Stephen Jacquemin, Ph.D., Chuck Ciampagio, Ph.D., and David Cicimurri

Chemosensitive Locus Coeruleus Neurons in the Savannah Monitor Lizard, Varanus Exanthematicus

Student Presenter(s): Lucas Zena, Graduate Student in Biomedical Sciences
FACULTY MENTOR: LYNN HARTZLER, PH.D.
DEPARTMENT: BIOLOGICAL SCIENCES

Savannah monitor lizards are unusual among poikilothermic vertebrates by maintaining arterial pH nearly constant during changes in body temperature (-0.003 U ˚C-1) in contrast to the typical α-stat regulating strategy (-0.015 to -0.017 U ˚C-1) of most other poikilotherms. Given the importance of cellular pH-sensitivity in the control of ventilation, we examined the CO2/H+ sensitivity of neurons from the locus coeruleus region of monitor lizard brainstems. Whole-cell patch clamp electrophysiology was used to record membrane voltage (Vm) in neurons within the locus coeruleus region in brainstem slices. Artificial cerebral spinal fluid (aCSF) equilibrated with 80% O2, 2-10% CO2, balance N2 was superfused across brainstem slices. Changes in firing rate of LC neurons were calculated from action potential recordings to quantify the chemosensitive response to hypercapnic acidosis. Preliminary results suggest that there are both excitatory and inhibitory chemosensitive neurons in the locus coeruleus region of the brainstem in monitor lizards. Upon exposure to hypercapnic acidosis (high CO2, low pH), firing rate of excitatory neurons increased from 1.2±0.4 Hz to 1.6±0.6 Hz while firing rate of inhibitory neurons decreased from 2.5±0.5 Hz to 0.72±0.3 Hz. 33% of LC neurons patched were excitatory, 47% were inhibitory, and 20% were not sensitive to hypercapnic acidosis. The large proportion of inhibitory neurons may contribute to relative decreased

respiratory drive enabling monitor lizards' ability to retain CO2 with cooling. Future experiments will include examination of chemosensitivity in other brainstem regions and the effect of temperature on chemosensitive neurons.

Assortative Fertilization in the Elegans-Group of Caenorhabditis

Student Presenter(s): Sara Selbert, Graduate Student in Biological Sciences
FACULTY MENTOR: SCOTT BAIRD, PH.D.
DEPARTMENT: BIOLOGICAL SCIENCES

Assortative fertilization refers to species-specific interactions between sperm and oocytes. One type of interaction is sperm chemotaxis. In Caenorhabditis fertilization is internal and amoeboid sperm must crawl along the uterine lining to the spermathecae in response to chemical signals. My ultimate goal is to identify gene(s) involved in species-specific chemotaxis within the Elegans-Group of Caenorhabditis. C.remanei sperm chemotax toward oocyte-derived signals from C. briggsae hermaphrodites and C. briggsae; C. sp. 9 female hybrids, but not toward C. sp. 9 females. Chemotaxis of C. remanei sperm was stronger in F1 hybrids than in C. sp. 9 parental females. I.e. C. briggsae allelic variants involved chemoattraction of C. remanei sperm were dominant. B2 females were constructed from back crosses of F1 females to C. sp. 9 males. B2 females appear to achieve an intermediate strength of chemotaxis between that in F1s and C. sp. 9 parental females. Moreover, 36% of the all variation in cross-fertility is explained by sperm chemotaxis. Regions of the C. briggsae genome that are involved with chemoattraction of C. remanei sperm are expected to be present in all chemotaxis-positive B2s. Further experimentation, will determine if other genetic models may be responsible for the segregation of positive chemotaxis in B2 females. These experiments will map these loci at higher resolutions and eventually allow for the identification of gene(s) involved in assortative fertilization in Caenorhabditis. This may help explain species-specific genetic variants influencing mechanisms preventing gene flow leading to the formation of new species.

Co-Authors/Collaborators: Blaine E. Bittorf, Scott E. Baird, Ph.D.

Biomedical, Industrial and Human Factors Engineering

Model-Based Approach to Understand and Develop Technology-Enhanced System for Engineering Education

Student Presenter(s): Kushal Abhyankar, Graduate Student in Biomedical & Human Factors Engineering

FACULTY MENTOR: SUBHASHINI GANAPATHY, PH.D.
DEPARTMENT: BIOMEDICAL & HUMAN FACTORS ENGINEERING

In the past few years, we are experiencing a steep increase of college attending population. Due to a steady dropout rate in engineering students, this number is increasing all across United States. Because of a heavy impact of the traditional teaching practices in engineering education, students often find themselves in a difficult learning environment. We present an idea of learning enhancement with the help of ubiquitous technology. This form of technology is universally accepted in daily lives in the form of smartphones and tablet devices. With the advancement in the computing capability of the mobile devices, their general use for quick information retrieval is increasing rapidly. By porting the engineering learning content on the mobile devices, enhanced with mobile based interactive additional content can definitely add another dimension in learning for the students. Understanding and aiding courses with appropriate technology can help faster concept acquisition and knowledge retention. In the initiation phase of this project, we conducted a user centered study across the engineering school to understand the pain points of the students in engineering. This presentation focuses on showcase of early results and addressing challenges in the area of knowledge acquisition and retention in the engineering education domain and will identify integration of technology that increases the effectiveness of information presentation and management to support and enhance learning. One of the direct outcomes of this project is the learning analytics system geared towards the performance analysis of the students. With the help of an intention predictive model called as user centered technology acceptance model, a better assessment of the decision influencing factors for the users to accept the technology can be done. This predictive model will be used across the entire test sample backed up by a detailed statistical analysis to maintain the reliability and validity of the model.

Co-Author/Collaborator: Subhashini Ganapathy, Ph.D.

MRI Aliasing

Student Presenter(s): Mohammad Almohaisin, Graduate Student in Biomedical Engineering

FACULTY MENTOR: NASSER KASHOU, PH.D.
DEPARTMENT: BIOMEDICAL & HUMAN FACTORS ENGINEERING

MRI artifacts are very common deformations in MR scanning. Aliasing is one common type of these artifacts. It is caused by the inadequate FOV size.

Process Control in Data Entry Devices

Student Presenter(s): Alexandra Comer, David Todd, and Lindsey Smith, Undergraduate Student in Industrial and Systems Engineering

FACULTY MENTOR: SUBHASHINI GANAPATHY, PH.D.
DEPARTMENT: BIOMEDICAL & HUMAN FACTORS ENGINEERING

Our senior design team was assigned to work with Beville Engineering, Inc., a refinery and petrochemical industry company in the field of human factors engineering and analysis services. The project we were

assigned asks us to experiment with different data entry methods to determine which process results in fewer errors. Beville has helped many companies diminish safety issues through their analytic approaches to solving human performance problems. A current possible performance issue lies with the petrochemical operators. Petrochemical operators control refinery processes through a manipulation of process variables including temperatures, pressures, flows and levels through a distributed control system, and often these inputs need to be made quickly or at high-stress times, causing entry errors. Inputs can be made through a variety of different methods; standard QWERTY keyboard and mouse, integrated mouse, a slider bar, or ramp keys. The goal is to calculate error rates for all of the input devices and determine which input method results in the least amount of errors.
The variables being tested are: method of input (ramp keys, slider bar, manual input of standard keyboard and mouse or integrated mouse), accuracy, speed, and number of clicks or attempts to reach the target value. The experiment includes acting as a petrochemical operator and changing the temperature, flow, process, or level values in a simulated controller. The experiment is being performed on a DeltaV simulation system, which is identical to the system the operators would use on the job. A test for speed/accuracy trade off was accounted for in this project as well. Half of the scenarios were time pressured, asking the participants to complete a set of tasks within a certain amount of time. The other scenarios were not time pressured, allowing for the possibility of 100% accuracy with each method.

Brain Segmentation and Analysis of Neonates with Dysphagia

Student Presenter(s): Irfaan Dar, Graduate Student in Biomedical Engineering
FACULTY MENTOR: NASSER KASHOU, PH.D.
DEPARTMENT: BIOMEDICAL & HUMAN FACTORS ENGINEERING

Background:
Feeding is a vital task for the development of neonates into healthy adults. Swallowing is a complex pathway that involves cortical and subcortical areas in the brain in connection with the esophagus. A disruption in this pathway can lead to dysphagia and other problems depending on the location of the disruption. Characterizing cortical and subcortical areas in the brain can lead to faster diagnosis of these potential swallowing problems in neonates.

Method:
Infants with swallowing issues (N=10) were recruited for MRIs based on the consultations of a neonatologist. Sagittal and axial MRI sequences were obtained using a consistent imaging protocol. Specific areas involved in swallowing the swallowing pathway such as the cerebellum, basal ganglia, brain stem, and cerebrum were segmented, and the volume was recorded. Ratios between the cerebellum, brain stem, basal ganglia, and brain were then calculated for each patient.

Results:
(MEAN ± SE) The ratio between the brainstem and cerebellum was .29±.07, brainstem and brain .02±.004, basal ganglia and brain .029±.007, cerebellum and brain .07±.02 in the sagittal direction, and cerebellum and brain .08±.01 in the axial direction.

Conclusion:
Due to the preliminary nature of the results, the meaning is not yet fully understood. By obtaining more patients that are neurologically normal, further analysis can be done. Cataloging the development of these vital structures in relationship to one another can help with maturational diagnoses at this stage in life.

Is fNIRS Ready for Use in Clinical Ophthalmology?

Student Presenter(s): Brenna Giacherio, Graduate Student in Biomedical Engineering
FACULTY MENTOR: NASSER KASHOU, PH.D.
DEPARTMENT: BIOMEDICAL & HUMAN FACTORS ENGINEERING

Introduction: Functional near-infrared spectroscopy (fNIRS) is a relatively young technique in the field of medical imaging. As such, it has yet to be widely implemented for clinical use, despite its promising advantages. However, unlike fMRI—its much bulkier and costly counterpart—fNIRS has yet to be proven as a standalone imaging tool within a clinical setting, particularly that of ophthalmology.

Methods: Ten healthy young adults (23.8 ± 4.8 years) participated in the study. Activation of the visual cortex was achieved utilizing various checkerboard stimuli across three data collection sessions for each participant. Data was processed with MATLAB (The MathWorks, Inc.) and statistical analysis was performed using JMP (SAS, Inc.).

Results: Quantitatively, statistically significant differences in the level of activation were elicited by some stimuli, but not others. Additionally, one of the three data collection sessions for each participant tended to give statistically different results than the other two. Qualitatively, the number of stimulus events and data channels which showed activation were inconsistent.

Conclusion: It has been shown, both previously and within this study, that fNIRS is feasible for investigating the visual cortex. However, a reliable level of robustness and sensitivity is required for clinical implementation. This research shows that fNIRS can achieve an appropriate level of sensitivity, but still lacks an appropriate level of robustness in terms of repeatability and corporal differences.

Investigating Structural Correlates of Idiopathic Infantile Nystagmus Syndrome using MRI-Based Brain Volumetrics

Student Presenter(s): Travis Goettemoeller, Undergraduate Student in Biomedical Engineering
FACULTY MENTOR: NASSER KASHOU, PH.D.
DEPARTMENT: BIOMEDICAL & HUMAN FACTORS ENGINEERING

Introduction: Idiopathic infantile nystagmus syndrome (IINS) is characterized by involuntary oscillatory movement of the eyes which occurs within 6 months of birth. The neural circuitry and cause of IINS is currently unknown. This study was designed to identify possible structural correlates of IINS through the use of magnetic resonance imaging (MRI) based brain volumetrics.

Methods: Structural MRI images were obtained from four subjects, consisting of two individuals with IINS and two age and gender matched controls. The images were analyzed using the automated segmentation tool from the open source software FreeSurfer. The processed data was analyzed to determine if any correlation existed between individuals with IINS and the volumes of several regions of interest in the brain.

Results: A paired t-test of the data resulted in no p-values below 0.05 for any of the brain regions analyzed. The null hypothesis was accepted for all regions of interest.

Conclusion: The preliminary results indicate that no correlation exists between individuals with IINS and the volumes of several regions of interest in the brain. A larger study is suggested to determine if these results are representative of all individuals demonstrating IINS.

Vibrotactile Feedback and Stochastic Resonance in a Laparoscopic Probing Task

Student Presenter(s): Robert Hoskins, Graduate Student in Industrial & Human Factors Engineering

FACULTY MENTOR: CAROLINE CAO, PH.D.
DEPARTMENT: BIOMEDICAL & HUMAN FACTORS ENGINEERING

One short-coming of using vibrotactile feedback for the purpose of increasing the information gained through the haptic channel is that adaptation to the signal occurs, rendering the augmentation ineffectual over time. Stochastic resonance (SR), introduced into the human control system as white noise at a sub-sensory level, has shown promise to improve the sensitivity of somatosensory receptors, and overall tactile and haptic abilities in human subjects. Conventional logic suggests that noise or any exogenous disturbance added to a system would lead to detrimental performance. Nevertheless, it is a promising solution to the habituation problem in vibrotactile feedback as well as a means to increase sensitivity to weak haptic signals which could provide valuable information to enhance performance. The purpose of this experiment was to investigate the benefits of a wearable vibrotactile device that provides useful information regarding the level of forces applied by subjects during a laparoscopic palpation task, and the relative contributions of the introduction of noise (stochastic resonance) into the system via a second vibrotactile device. We hypothesized that vibrotactile feedback and the addition of stochastic resonance would enhance performance during the laparoscopic probing task. Subjects performed a simulated laparoscopic palpation task involving the detection of an embedded "tumor" in a silicone "tissue" sample. Detection accuracy, time to task completion and the complete force profiles were recorded for each subject under four different conditions: with vibrotactile stimulation (VIB), with sub-sensory stimulation (SR), with both vibrotactile and sub-sensory stimulation (VIB-SR) and with no stimulation (CONTROL). Thus far, results from 10 subjects show improvement in both time and error rate for trials performed under the SR condition over the CONTROL condition. We postulate that as we continue to collect data on more trials that the significance of improvement seen in the SR condition will increase.

Volumetric Analysis of Hydrocephalus Patients in Pediatrics

Student Presenter(s): Ali Kadhim, Undergraduate Student in Biomedical Engineering

FACULTY MENTOR: NASSER KASHOU, PH.D.
DEPARTMENT: BIOMEDICAL & HUMAN FACTORS ENGINEERING

Purpose: Calculation of pediatric ventricle to brain ratio (VBR) from 3D MR has the potential to improve patient outcomes by increasing accuracy of diagnosis by utilizing rapid imaging not requiring sedation, while also avoiding radiation from CT. Ventricular volume analysis will be performed and compared to prior qualitative evaluation with retrospective review of clinical course. This will be the first study to apply the VBR technique on patients with Ventricular shunts by assessing the utility of VBR calculation in pediatric patients for evaluation of hydrocephalus.

Methods: Chart review of 10 patients with 0-18 years of age that had an MRI to evaluate ventricular size and to perform a volumetric analysis of the ventricles in comparison to the brain.

Results: Preliminary results will be presented.

Conclusion: Assessment of ventricular size is important to pediatric patients with macrocephaly or hydrocephalus, particularly those patients with CSF shunts. MRI is useful as a serial exam to evaluate ventricular size, as it decreases the lifetime radiation burden which would otherwise accumulate with serial head CTs. Volumetric techniques are the most accurate measurement of ventricle size. However, treatment decisions are most often based on

qualitative evaluation of ventricle size. MR based VBR calculations haven not been reported in young pediatric patients who in the past would have required sedation for the MRI.

Functional Magnetic Resonance Imaging of Convergence Eye Movements

Student Presenter(s): Chirag Limbachia, Undergraduate Student in Biomedical Engineering

FACULTY MENTOR: NASSER KASHOU, PH.D.
DEPARTMENT: BIOMEDICAL & HUMAN FACTORS ENGINEERING

Introduction: Convergence Insufficiency is a sensory and neuromuscular disorder of binocular vision system, characterized by a reduced ability of eyes to turn towards each other, or sustain convergence. Convergence is an important physiological function. It helps maintain proper binocular vision by fusing the images of an object formed on the retina of the two eyes into a single image and give a perception of depth to the viewer. Absence of convergence or CI may cause blurred vision, double vision, frequent loss of place, inability to concentrate when performing close work like; reading, computer work, desk work, etc.
Purpose: To quantify functional neural changes associated with convergence eye movements with long term objective to correlate with vision therapy in subject with convergence insufficiency (CI), and to establish brain regions that are responsible for convergence.
Method: Functional magnetic resonance imaging (fMRI) scans were collected using a 3T GE Scanner using a block design. The subjects used a wooden stick with a split prism attached to it (12BO and 3BI) to alternately view a fusion target (on condition). In a second series of experiment, the subject fused through 12 prism diopter base-out prism (on condition) as MRI scanning was performed. The off condition was fusion through a 3 prism diopter base-in prism. Four series of on/off sequences (2.5 minutes each) were performed. Data were analyzed using fMRI Expert Analysis Tool (FEAT) in FSL for preprocessing and statistical analysis.
Results/Conclusion: Preliminary results showed activation in the visual cortex and in the cerebellum ($z > 5.3$ and a cluster significance threshold of $p < 0.05$). These data will allow us to better design the experimental paradigm to further isolate regions associated with convergence insufficiency. A study is under way to apply fMRI longitudinally during vision therapy of patients who suffer from CI.

Supporting Procedural and Perceptual Learning in Laparoscopic Surgery

Student Presenter(s): Yiman Lou, Graduate Student in Industrial & Human Factors Engineering

FACULTY MENTOR: CAROLINE CAO, PH.D.
DEPARTMENT: BIOMEDICAL & HUMAN FACTORS ENGINEERING

Expertise in surgical performance requires mastery of both technical skills such as suturing, and non-technical skills such as perceptual and procedural knowledge. Training to support re-learning after skill decay due to nonuse should consider the fact that non-technical skills decay faster than technical skills. In supporting the re-learning of perceptual and procedural knowledge, this study examines the effectiveness of digital training material design. The factors considered for the design of training material included fidelity of representation (illustration/cartoon vs. realistic/video images), and levels of task difficulty (easy, medium and difficult). Results suggest that low fidelity images are better for perceptual learning while high fidelity images may be better suited for procedural learning. Time and error results indicate that refresher training in perceptual and procedural knowledge should begin with a procedural task to review surgical steps, followed by a perceptual task, to achieve greater efficiency and effectiveness. The level of difficulty of the tasks did not affect performance in this

study of novices, but may be an important factor with more experienced trainees.
Co-Authors/Collaborators: Caroline Cao, Ph.D. and Jeff Flinn, M.S.

Computer Aided Diagnostic for Surgeons: Using Kinect in Laparoscopic Surgery

Student Presenter(s): Mohammadreza Maddah, Graduate Student in Engineering

FACULTY MENTOR: NASSER KASHOU, PH.D.
DEPARTMENT: BIOMEDICAL & HUMAN FACTORS ENGINEERING

Robot assisted or robotic laparoscopic surgery is the most recent used method which has better performance and lower side effects in comparison with the standard laparoscopic surgery. Robotic Laparoscopic surgery allows greater precision and better visualization compared to standard laparoscopic surgery. One of the issues with robotic laparoscopic surgery is to locate the entrance ports for the robot arms to prevent collision between them. Well positioned ports also provides surgeon better accessibility of target organ. It means that, with an exact port placement, there would be enough space of working and ease of surgeon manipulating inside the patient's body. As a common procedure, surgeons usually use their own knowledge and experience to mark the best points for ports on the abdomen manually. Previous attempts to port placement also did not use real data in operating room to resolve the problem. In order to overcome difficulties in port placement, it is very important to have a complete model of abdomen during insufflation. Complete model should take into account the abdomen's internal space and its outer shape. A novel computer assisted system is proposed to model outer shape of abdomen to aid surgeons in port-placement. During the insufflation stage of laparoscopic surgery, the system uses a Kinect Camera to capture images with depth information on the insufflated region of abdomen. The captured images then are used to create a 3D model of the patient's abdomen before and after insufflation. Abdominal deformation after the insufflation can be calculated knowing the shape and the total volume of the inside workspace can help surgeon to evaluate the best location for the port entrances. Further, more information, such as which areas inside of the abdomen should be avoided, can be provided to the surgeon.

Information Presentation on Mobile Devices for Small Form Factors

Student Presenter(s): Raghavendra Rao Polakonda, Graduate Student in Human Factors & Industrial Engineering and Organizational Psychology

FACULTY MENTOR: SUBHASHINI GANAPATHY, PH.D.
DEPARTMENT: BIOMEDICAL & HUMAN FACTORS ENGINEERING

Process control and maintenance systems have been used in the petrochemical and refining industry for long time for improving operator performance and workforce efficiency. Advances in mobile computing, sensor technologies, software algorithms, and computational methods provide the possibility for easy access to information anytime- anywhere. The issues associated with retrieving and reviewing this information directly affects the ability to make timely and quality decisions in high stakes environments like a petrochemical plant where time critical decision making contexts are involved. The purpose of this research study is to understand the utility of mobile systems in presenting information for process control and maintenance systems. This research study focuses on identifying utility of mobile devices for information presentation of control elements and the related alarm information for field operators in the process industry.

"Yelling will not make me learn better!"

Student Presenter(s): Natallya Pyatka, Graduate Student in Medicine
FACULTY MENTOR: CAROLINE CAO, PH.D.
DEPARTMENT: BIOMEDICAL & HUMAN FACTORS ENGINEERING

Objective: This research examined the effects of different types of interaction in the attending-learner relationship on the acquisition and performance of laparoscopic skills.

Background: Clinical faculty, especially on surgical rotations, is perceived as significant sources of stress for medical learners. 50-85% of medical students claim to have endured some sort of "abuse," with verbal abuse being the most common.

Methods: 43 1st-4th year medical students learned to perform a pattern cutting task using laparoscopic tools. They were divided into 4 groups: Control – no surgeon present; Present – silent surgeon observer; Encouraging – surgeon provided positive feedback; Stressed – surgeon provided harsh critique. HR, BP, skin conductance, eye blink rate, cortisol, abbreviated STAI test (subjective stress) were the physiological measurements taken. To grade performance, time to task completion and pattern cutting error were measured.

Results: The stressed group had higher perceived level of stress, cortisol levels, BP, and HR that also remained higher. The stressed group also had the lowest error, but slowest task times. Encouraging group's perceived level of stress was the lowest at the end of the study.

Conclusion: In this study, stress led to slower, but more accurate performance. Positive feedback led to faster performance times and faster learning. These results will provide awareness to surgical programs to improve training and patient safety in the operating room.

Co-Authors/Collaborators: Jeff Flinn, Amie Miller, Jacob Brewer, Jinling Wang, Yiman Lou, and Caroline Cao, Ph.D.

Low-Cost Digital X-ray Image Receptor Design

Student Presenter(s): Lucas Stork, Megan Markl, Katherine Gamber, and Amena Shermadou, Undergraduate Students in Biomedical Engineering
FACULTY MENTOR: THOMAS HANGARTNER, PH.D.
DEPARTMENT: BIOMEDICAL & HUMAN FACTORS ENGINEERING

In many underdeveloped countries there is a deficiency of medical equipment and technology, especially in rural hospitals. The scarcity of hospitals in these regions causes patients to seek medical attention only if they have serious conditions. Naturally, a primary concern is the inability to take radiographic images. Some health-care facilities have access to traditional X-ray imaging methods; however these methods require film and developing supplies, which need to be replenished often. Providing a digital image receptor would allow these facilities to become self-sufficient and no longer require outside resources. However, the cost of such currently available systems is prohibitive for these hospitals. The goal of this design is, therefore, to develop a low-cost, digital image receptor for radiographic imaging, which is appropriate for the type of radiographs typically taken at a rural hospital in a developing country. The designed image receptor meets specific criteria defined by the current analog X-ray system at Kaseye Community Hospital in Malawi. Based on these criteria, the device does not exceed 40 centimeters in depth, and to achieve diagnostic quality, the device is able to provide a resolution of 2.5 line pairs per millimeter. Another feature the design includes is the ability to wirelessly transfer images to a computer. The overall design is portable and is comprised of off-the-shelf components so it can be easily replicated for other hospitals in developing countries. The design uses a medium-performance digital camera to obtain the image produced by a fluorescent X-ray screen synchronized with the exposure through the x-ray tube. The camera is housed in a lightproof casing to ensure the highest image quality from the X-

ray screen and the camera sensor is shielded from radiation by means of a transparent, attenuating material. The device will be installed by Wright State students in Malawi in May 2014.

Near-Infrared Spectroscopy Device for Imaging the Breast

Student Presenter(s): Emma Sum, Undergraduate Student in Biomedical Engineering and Molly Gossard, Undergraduate Student in Biomedical Engineering
FACULTY MENTOR: NASSER KASHOU, PH.D.
DEPARTMENT: BIOMEDICAL & HUMAN FACTORS ENGINEERING

Introduction: Near-infrared spectroscopy (NIRS) is a non-ionizing imaging modality that detects differences in oxygenated and deoxygenated hemoglobin in the blood by exciting tissue with near-infrared photons and measuring the attenuation of the optical signal. Commonly used in functional studies of the brain, NIRS also shows potential as a preventative and diagnostic breast cancer imaging modality. This study examines the benefits and potential effectiveness of using NIRS to create an image of breast tissue as an alternative to the clinical standard of x-ray mammography.
Methods: Pre-existing apparatuses for imaging the breast with NIRS were studied. Using the source-detector probes of a NIRScout System as the underlying infrared technology, designs for new breast imaging devices were modeled in SolidWorks.
Results: The general design of multiple device configurations will be presented, highlighting their clinical advantages such as efficiency, safety, and patient comfort.
Conclusion: Using the proposed models, future work will include prototyping devices through a three-dimensional printing process and conducting clinical studies to optimize imaging configurations.
Co-Authors/Collaborators: Molly Gossard, Nasser Kashou, Ph.D.

Develop a Computer-Aided Tool for Visualization of the Abdomen during Insufflation

And

Making a Model of the Abdomen during Insufflation (Laparoscopic Surgery)

Student Presenter(s): Zohreh Tavakkoli, Graduate Student in Biomedical Engineering
FACULTY MENTOR: NASSER KASHOU, PH.D. AND CAROLINE CAO, PH.D.
DEPARTMENT: BIOMEDICAL & HUMAN FACTORS ENGINEERING

Introduction: Robot-assisted laparoscopic surgery is gaining popularity because it has been associated with reduced blood loss and shorter hospital stays for patients while providing ergonomic advantages to the surgeon over conventional laparoscopic surgery. However, it can result in a longer preoperative planning process. Previously, laparoscopic surgery often presented difficulties for surgeons to find the best location for port placement of robotic arms .A patient with unusual morphology requires a great deal of trial- and-error adjustments due to unique morphology - anatomical features and characteristics that are specific to every patient and may have an affect on the performance of a surgeon. The purpose of this study is to develop a computer aided tool (CAD) to assist the surgeons during the planning process.
Method: Data was collected during eight surgical procedures, using a video camera (Panasonic HC-V700). The images acquired included side and top perspectives of the patient's abdomen before and after insufflation were imported and processed using MATLAB (www.mathworks.com) and A graphical user interface (GUI) will be developed in order to help visualize the results.
Results: Automatic and manual measurements of pre and post insufflation displacement were obtained. Preliminary results of the CAD measures and manual

method were comparable in both side and top perspectives.
Discussion: Accurate measures of the size of the abdomen and other parameters, such as displacement during insufflation and body mass index (BMI), will aid in determining the optimal workspace required for a surgeon to manipulate surgical tools and have the best view of targeted organs for the best surgical performance. Future work will evaluate this GUI to assist surgical planning.

Functional Magnetic Resonance Imaging (fMRI) for Predicting Performance Based on Visual Object Recognition Task

Student Presenter(s): Mohd Usmani, Graduate Student in Biomedical Engineering
FACULTY MENTOR: NASSER KASHOU, PH.D. AND ION JUVINA, PH.D.
DEPARTMENT: BIOMEDICAL & HUMAN FACTORS ENGINEERING

Background: Functional magnetic resonance imaging (fMRI) allows the indirect detection of neuronal activity in the brain based on the blood-oxygenation-level-dependent (BOLD) signal.
Cognitive models based on theory of adaptive control of thought-rational (ACT-R) and neuroimaging data are commonly used. These cognitive models can be developed to match the neural signature and behavior output of participants trained on visual object recognition task. If they are matched, the models can predict the performance of the individuals in different training sessions.
Purpose: To utilize fMRI alongside with the cognitive models, in order to better understand how participants learn based on a visual memory task.
Methods: Participants will undergo seven behavioral sessions and three fMRI sessions. Both session types will use an event related visual paradigm via computer and projector screens respectively. Concurrent eye tracking (EyeLink) will be performed on computer to keep track of the eye movements of the participants during the behavioral sessions.
Results/Conclusion: Preliminary data from five participants showed that overall accuracy level of above 90% was achieved by 4 of the 5 participants by the end of study. The sessions 4-6 were marked by an accuracy plateau and the subjects responded quicker compared to the earlier sessions. It consisted of 6 behavioral sessions conducted on 5 participants chosen randomly from a pool of potential participants. Combining the fMRI data and the cognitive models will further allow us to better understand the learning process.
Co-Authors/Collaboration: Nasser Kashou, Ph.D., Ion Juvina, Ph.D., Priya Ganapathy, Ph.D.

Skull Fracture in Head Impacts

Student Presenter(s): Anthony Vicini, Graduate Student in Biomedical Engineering
FACULTY MENTOR: TARUN GOSWAMI, PH.D.
DEPARTMENT: BIOMEDICAL & HUMAN FACTORS ENGINEERING

In contact sports, head-to-head collisions can lead to skull fracture and other injuries, which pose serious health risks to the players. Currently, some equations such as the Head Injury Criteria exist to model concussion, diffuse axonal injury, and hematoma formation, but these equations all have limitations to their applicability and have limited use for modeling fracture. This research aims to understand what factors lead to fracture using finite element analysis of an actual skull model in the efforts of creating a similar model for fracture. Forces were applied to the model from differing directions and the results were assembled into a risk formula.

Diffusion Tensor Imaging and Segmentation for Infantile Nystagmus

Student Presenter(s): Angelica Zampini, Undergraduate Student in Biomedical Engineering

FACULTY MENTOR: NASSER KASHOU, PH.D.
DEPARTMENT: BIOMEDICAL & HUMAN FACTORS ENGINEERING

Background: Infantile nystagmus syndrome (INS) is a periodic rhythmic oscillation of the eye usually beginning in infancy. There are no conclusions drawn associating INS to abnormality of the visual sensory pathway or a neurological impairment; therefore, the majority are idiopathic. This study used diffusion tensor imaging (DTI) and segmentation to manually identify the regions of interest (ROI) in the brain correlating to oculomotor function. The goal is to determine the statistical significance of the average number of neural track fiber and voxel differences between control and INS subjects to yield clinical conclusions.

Methods: 3 adults with INS and 3 control subjects are included in this analysis using Trackvis computer-based neuroimaging software. They were evaluated in a clinical MRI scanner collecting DTI data. The image data was analyzed using a three-dimensional modeling technique called tractography to represent track fibers visually. Voxels for each ROI were isolated by manual segmentation in Trackvis. The ROI included in this study are the right and left cerebellum, whole brainstem, pons and thalamus. Furthermore, the statistics recorded the number of track fibers and voxels for each ROI to be averaged in order to take the percent differences.

Results: Based on the percent differences, the right cerebellum (14.0%), left cerebellum (9.2%), brainstem (18.6%), and pons (15.9%) prove statistical significance unlike the thalamus (2.5%) with relatively no difference between INS and control subjects.

Future Work: Further statistical analysis including two sample t-tests will be run on the completed ROI as well as any future ROI. The optic chiasm is a potential region of interest due to their influence in oculomotor function. The optic chiasm is where the nasal fibers of the optic nerve cross and synapse at the lateral geniculate nucleus of the midbrain, which is also responsible for oculomotor function. Overall, determining the clinical significance of neural fiber disconnectivity is the study's objective.

Co-Author/Collaborator: Nasser Kashou, Ph.D.

Chemistry

Effect of Alkyl Chain Length on the Thermal Properties of Poly(arylene ether)s Derived From N-Alkyl-N-Phenyl-3,5-Difluorobenzene Sulfonamides

Student Presenter(s): Marina Andrejevic, Graduate Student in Chemistry
FACULTY MENTOR: ERIC FOSSUM, PH.D.
DEPARTMENT: CHEMISTRY

Meta-activated nucleophilic aromatic substitution leads to poly(arylene ether)s, PAE, in which the activating group resides in a pendant position relative to the polymer backbone. The nitrogen atom in the strongly activating sulfonamide provides a point of chemical diversity that can be exploited to tailor the physical properties of the resulting polymers. Using N-phenyl-3,5-difluorobenzene sulfonamide group as the starting material a series of N-alkyl derivatives, with chain lengths of 3 to 12 carbon atoms, were prepared and characterized followed by conversion to the corresponding PAE. The effect of alkyl chain length on the thermal stability and glass transition temperatures, Tg, values was determined.

Determination of the Intracellular Fate and Trafficking of Chelereythrine, a Potent BH3 Mimetic and Na+/K+ ATPase Inhibitor, in Human Lens Epithelial Cell Cultures via Surface-Enhanced Raman Spectroscopy (SERS)

Student Presenter(s): Kevin Dorney, Graduate Student in Chemistry
FACULTY MENTOR: IOANA SIZEMORE, PH.D.
DEPARTMENT: CHEMISTRY

Chelerythrine (CET) is a quaternary benzophenanthridine alkaloid (QBA) and potent pro-apoptotic capable of inhibiting the Na+/K+ ATPase (NKA) in human lens epithelial cell (HLEC) lines. Despite the medicinal use of CET and other structurally related QBAs for centuries, the mechanism and intracellular fate of CET is largely speculated and unknown. To this end, this study aimed to track the distribution and quantitatively determine the degree of accumulation of CET within various cellular compartments via surface-enhanced Raman spectroscopy (SERS)-based nano-sensing. HLECs were treated with 50 mM of CET in 300 mOsM phosphate buffered saline solution for 30 minutes at 37 °C, a time sufficient to induce apoptosis and inhibit the NKA Cytosolic, crude and purified (i.e., free of mitochondrial, nuclear material, etc.) plasma membrane, and whole cell extracts were obtained and incubated with ultraconcentrated, unfunctionalized Creighton colloidal silver nanoparticles (AgNPs) for SERS sensing. The SERS analysis rapidly detected the presence of a large amount of intracellular CET while concurrently yielding the concentration of free CET in each extract via a linear calibration function of the integrated band area of the 659 cm-1 phonon mode. The CET concentration within the cytosol of HLECs was found to be near passive diffusion equilibrium, suggesting rapid transmembrane transport as a cationic monomer. However, when normalized for total protein content, the CET content was found to be nearly 100 fold higher in the plasma membrane than cytosolic extracts. These data suggest and provide further support to the recent observations indicating that CET expeditiously enters and distributes inside the cell with a potential high affinity for plasma membranes, which contain a high amount of P-type ATPase such as the NKA.

Co-Authors/Collaborators: Ioana E. Pavel-Sizemore, Ph.D., Department of Chemistry, Tariq Alqahtani, Department of Pharmacology & Toxicology and Cell Biophysics Group, Norma C. Adragna-Lauf, Ph.D., Pharmacology & Toxicology and Bell

Biophysics Group, Peter K. Lauf, Ph.D. Department of Pharmacology & Toxicology, Cell Biophysics Group, and Pathology

Aryl Alkoxy Polyethers

Student Presenter(s): Juraj Drzic, Graduate Student in Chemistry
FACULTY MENTOR: WILLIAM FELD, PH.D.
DEPARTMENT: CHEMISTRY

The ready availability of monobenzyl-protected diphenols has led to the synthesis of a series of building blocks for use in the preparation of unique monomers. The reaction of benzyloxyphenol, as well as related systems, with [illegible]-dibromoalkanes followed by deprotection leads to a series of AB monomers. Similarly, the reaction of appropriate benzyloxyaryloxyalkyl bromides or tosylates with 4-fluoro-4'-hydroxybenzophenone leads to a series of unique PEEK related AB monomers. Traditional difunctional monomers can be synthesized by the reaction of bis(bromoethoxy)benzene and related aromatics with 4-fluoro-4'-hydroxybenzophenone. Polymerization of these monomers can be conducted in NMP using K2CO2 as a base and toluene as an azeotroping agent.

The Reaction of 3-Phenyl Syd with Bromine in Acetic Anhydride: A Reinvestigation

Student Presenter(s): Thijs Gerritsen, Undergraduate Student in Chemistry
FACULTY MENTOR: KENNETH TURNBULL, PH.D.
DEPARTMENT: CHEMISTRY

The preparation of 5-methyl-3-phenyl-1,3,4-oxadiazol-2-one by the treatment of 3-phenyl syd with bromine in acetic anhydride has been reinvestigated and the previously suggested 1,3-dipolar cycloaddition mechanism has been refuted. The scope and limitations will be described.

Synthesis of Main Chain Alkoxy Substituted DP-PPV

And

Application of HWE to DP-PPVs

Student Presenter(s): Jeremy Lear, Graduate Student in Chemistry
FACULTY MENTOR: WILLIAM FELD, PH.D.
DEPARTMENT: CHEMISTRY

The synthesis of 5-benzyloxy-1,4-bis(chloromethyl)-2,3-diphenyl benzene (1) was achieved via an established general pathway. Polymerization of (1) was carried out using the Gilch Method and resulted in an orange/yellow polymer, poly(5-benzyloxy-1,4-bis(chloromethyl)-2,3-diphenyl benzene) (2), which was composed of mostly insoluble material. Despite this, soluble portions of (2) were obtained and analyzed using TGA, DSC, GPC, UV-Vis and Fluorescence studies. It was found that the soluble portions of (2) had an Mn of 6603 Da, an Mw of 7136 Da, a PDI of 1.08, a Td5% of 267, with a maximum absorbance of 406 nm and a maximum emission of 509 nm. No free standing film could be cast from (2).
The Horner-Wadsworth-Emmons (HWE) variant of the Wittig reaction was utilized as a polymerization technique in the synthesis of poly(2,3-diphenylphenylene vinylene) (DP-PPV) (3). The phosphonate monomer, 1,4-bis(diethoxyphosphorylmethyl)-2,3-diphenyl benzene (3), was synthesized using the Michaelis-Abuzov reaction between 1,4-bis(chloromethyl)-2,3-diphenyl benzene (4) and triethylphosphite. HWE polymerization parameters are now being investigated.
Co-Author/Collaborator: William Feld, Ph.D.

Synthesis of a Haplomyrtin Precursor from a TIPS Protected Intermediate

Student Presenter(s): Bram Spierenburg, Undergraduate Student in Chemistry
FACULTY MENTOR: WILLIAM FELD, PH.D.
DEPARTMENT: CHEMISTRY

Previous synthetic efforts directed at Haplomyrtin focused on the use of a benzyl protective function in the preparation of an intermediate 2-phenylbenzofuran. The use of a TIPS protective group affords a distinct advantage in this preparation. Thus, the reaction of 6-bromovanillin with triisopropylsilylchloride produces 2-bromo-4-triisopropylsilyoxy-5-methoxybenzaldehyde. Protection of the benzaldehyde function as the cyclic ethylene ketal is followed by a lithium halogen exchange reaction and a subsequent reaction of the lithium intermediate with piperonal to produce a non-isolatable alcohol. Immediate reaction of the alcohol with an acid catalyst in the presence of dimethyl acetylenedicarboxylate (DMAD) produces the Diels-Alder product dimethyl 1-(1,3-benzodioxol-5-yl)-4-hydroxy-6-methoxy-7-triisopropylsilyloxynaphthalene-2,3-dicarboxylate, a Haplomyrtin precursor.

Oxyalkylene Linked Polyimide with Aromatic Subunits

Student Presenter(s): Kristy Wickman, Graduate Student in Chemistry
FACULTY MENTOR: WILLIAM FELD, PH.D.
DEPARTMENT: CHEMISTRY

Flexible oxyalkylene ether linkages within the polyimide backbone have been shown to decrease Tg but do not have a deleterious effect on thermal stability. Several diamine compounds with oxyalkylene ether linkages were synthesized by the usual reaction of diols with p-fluoronitrobenzene followed by chemical reduction. The diamines were converted to polyimides by using 4,4'-(hexafluoroisopropylidene)-diphthalic anhydride (6FDA) in a one-pot, amic-acid/imidazation procedure in m-cresol. The fully closed imides could be casted into transparent, creasable films and exhibited a 5% weight loss at >400° and appeared to exhibited a thermal transition ranging from 186-231° by DSC. Currently, synthesis is in progress for another diamine, bis(4-(4-aminophenoxy)ethoxy)-phenyl) diphenyl-methane, and will be reacted with 6FDA to produce a polyimide which will provide comparison for thermal properties.

Co-Authors/Collaborators: William Feld, Ph.D.

College of Nursing and Health

The Role of the Nurse in Family Coping After Miscarriage

Student Presenter(s): Wesley Hannebaum, Undergraduate Student in Nursing
FACULTY MENTOR: LISA SMITHERS, M.S.N., R.N., C.N.M.
DEPARTMENT: COLLEGE OF NURSING AND HEALTH

Approximately one in five women who are pregnant will miscarry (Rowlands & Lee, 2010). Miscarriage is an overwhelming experience not only for the women who lose their baby, but their partners as well. It has been found that most couples are not satisfied with the emotional care they receive following a miscarriage (Stratton and Lloyd, 2008). Society oftentimes does not see miscarriage as a concern to men, and thus their feelings are often ignored (Rinehart and Kiselica, 2010). Miscarriage can also affect other involved family members, such as grandparents and children (Roose and Blanford, 2011). The stress families experience during a miscarriage causes increased risk for the development of mental disorders (Brier, 2004) and relationship issues (Swanson, et. al., 2009). It is important that nurses implement proper interventions to help these families cope with their loss while going through the grieving process. The focus of this project is a thorough review of the literature to find which interventions nurses can use to best care for women and their families to facilitate coping after miscarriage. This is significant to nursing practice because research has shown that the care provided in the hospital can have a significant effect on the recovery from and experience of having an unexpected miscarriage (Stratton and Lloyd, 2008). Further research is needed to develop an understanding of best practice interventions nurses can implement for the entire family unit in order to close this gap in patient care.

Postoperative Pain Management in Adult Knee Arthroplasty Patients

Student Presenter(s): Stephanie Isaac-Francis, Graduate Student in Nursing
FACULTY MENTOR: PATRICIA MARTIN, PH.D.
DEPARTMENT: COLLEGE OF NURSING AND HEALTH

Problem: Total knee arthroplasty (TKA) procedures produce significant post-operative pain. Ineffective pain management in adult TKA patients can negatively affect mobility, rehabilitation, length of stay, and hospital costs. The dual issue of severe postoperative pain and the importance of early ambulation make pain control a challenge.

Purpose: The purpose of this project was to review evidence regarding the use of femoral nerve block (FNB) postoperatively in adults undergoing TKA and to determine if the evidence supported the use of this treatment as a superior modality of pain management when compared to the method current utilized which consists of patient controlled analgesia (PCA) morphine.

Search Strategy: A literature search of the Cochrane library, Cumulative Index for Nursing and Allied Health Literature and MEDLINE via PubMed was conducted. Key terms and subject headings used were “total knee replacement; total knee arthroplasty; femoral nerve block; intravenous pain controlled analgesia; pain control and pain management”. Inclusion criteria were post-operative TKA patients 18 years of age or older with in-hospital pain management up to 48 hours who received a FNB and/or PCA.

Results of Literature Search: The search resulted in 316 references. Results were narrowed to studies providing Level I or II evidence. Twelve studies were appraised and the six articles providing the most useful data were selected for inclusion.

Synthesis of Evidence: A total of 1,544 participants from four randomized controlled trials, one meta-analysis and one systematic review were analyzed. Five of six studies

showed FNB's significantly reduced post-operative pain when compared with PCA. Three studies showed a clinically significant decrease in morphine consumption. Noted gaps were cost effectiveness between different modalities of pain management and FNB failure rates.
Implications for Practice: The expected outcome of implementing the practice change is reduced post-operative pain during activity. The primary facilitators would be the EBP committee and EBP champions experienced in fielding new processes. These individuals will develop the tools necessary to educate the facility on the guideline, act as resource personnel during its implementation, evaluate the outcome and make necessary adjustments.
Co-Authors/Collaborators: William Wilson, M.D., Amy Kosanovich, Laura Langenhop, Carol Pierce, and Melissa Sullivan

Development and Testing of an Educational Intervention to Increase Knowledge of STI & HIV/AIDS Prevention among Low Risk Pregnant Women: The Project TO-R-CH

Student Presenter(s): Pratibha Nigam, Undergraduate Student in Nursing
FACULTY MENTOR: ROSEMARY EUSTACE, PH.D., CFLE, PHCNS-BC, RN AND DR. ROSALINE MAINOUS PHD, APRN, NNP-BC
DEPARTMENT: COLLEGE OF NURSING AND HEALTH
Background and Significance: About 499 million incidences of STIs including 34 million cases of HIV/AIDS occur in the world yearly, costing trillions of dollars and human suffering. Studies have found the knowledge deficit related to STI prevention among pregnant women and a positive association between STIs and infant prematurity leading to increased infant mortality rate.
Purpose: To develop and test an educational intervention, the project 'TO-R-CH' to increase knowledge related to STIs and HIV/AIDS among pregnant women attending Centering Pregnancy at Women's Health Center, University of Cincinnati Medical Center, OH.
Research Question: Will the project 'TO-R-CH' increase the knowledge related to STI & HIV/AIDS prevention among low risk pregnant women attending Centering Pregnancy?
Methods:
Design: Pretest-posttest, quasi-experimental
Sample: Convenience consists of 12 pregnant women.
Inclusion Criteria: Low risk pregnancy, gestational age greater than 12 weeks, ability to read and write in English, and attending Centering Pregnancy
Development of a teaching manual with a bidirectional model the 'TO-R-CH' (To Right Change): Guided by Information Motivation Behavior Skills Model, emphasizes 'Bidirectional' innovative teaching strategies using Triple 'AAA' (Appropriate use of words, Appropriate Attitude, and Appropriate non- verbal communication) with enjoyable methods (such as using acronyms 'ACKNOWLEDGE that you care (see the teaching manual), and the participants' involvement in the form of discussions and interactive learning activities increasing participants' knowledge, efficacy and motivation.
Implementation: Before intervention the participants' knowledge scores were obtained. Based on the model the 'TO-R-CH', two 45 minutes discussions and learning activities sessions were provided and then the post-test was administered.
Conclusion: Data were analyzed using Wilcoxon signed rank test and found that the 'TO-R-CH' significantly increased the post-test knowledge mean scores among the participants.
Implication: Change in the existing teaching method and use of a bidirectional model the 'TO-R-CH'
Co-Authors/ Collaborators: Harrieth Mwalupindi, MSN. RNC-OB, Ruby Crawford-Hemphill, RNC, BSN, MSA, Jen Boyers, BSN, RN

Medication Discrepancies in Aeromedical Evacuation

Student Presenter(s): Catherine Ortega, Maj, USAF, NC, AHCNS
Graduate Student in College of Nursing and Health
FACULTY MENTOR: ANN BOWLING, PH.D.
DEPARTMENT: COLLEGE OF NURSING AND HEALTH

Purpose: The purpose of this study was to determine within the military aeromedical evacuation (AE) system the medication discrepancies found in the patient movement records.

Background/Significance:
Many of the military programs related to patient safety were adopted from the civilian health care industry while aeromedical evacuation (AE) safety procedures were influenced by the aviation industry. AE is considered more complex due to the flight environment, the variety of patient acuity, and the mix of care provider backgrounds. Medication errors are the second largest category of patient safety incidents in AE. An important step in understanding barriers and improving patient safety is identifying gaps in the administration of medication during AE transports.

Theoretical/ conceptual framework: We adopted a Systems-Oriented approach to identify errors with a goal to prevent harm to patients, by utilizing the five rights of medication administration guidelines and anticipating errors utilizing the medication administration errors reduction principles, results from this study will be used to modify our current practices as appropriate.

Method: Following institutional review board approval, a retrospective review of 215 de-identified PMRs was conducted to examine the frequency and type of medication errors that occurred during AE flights. Records were selected from missions arriving at Ramstein Air Base, Germany; Joint Base Andrews, MD; and San Antonio, TX. No more than 10 patient records were selected from each flight. Univariate statistics were used to describe general medication information. Bivariate statistics were calculated to identify associations between variables.

Discussion: Although 89 (41%) of the records had some type of medication discrepancy, 875 medications were delivered in-flight. Therefore, crewmembers had a 1 in 10 chance to commit a medication error. The majority of errors were associated with inaccurate transcription. These errors were usually associated with PRN medications and self-administered medication (SAM) status. Discrepancies associated with the documentation of controlled substances were usually associated with SAM patients. The San Antonio trip segment had fewer transcription discrepancies and fewer opportunities for error, but a greater percentage of required narcotic counts that were not documented. Charting of the time, route, and the right dose accounted for the majority of documentation (omission) errors, especially with analgesic and narcotic medications.

Co-Authors/Collaborators: The principal investigator is Lt Col Susan Dukes, USAF, NC. Co-investigators are Col Elizabeth J. Bridges, USAF, NC; Col Margaret M. McNeill, USAF, NC; and Maj.

Computer Science

Extracting City Events from Social Streams

Student Presenter(s): Pramod Anantharam, Graduate Student in Computer Science
FACULTY MENTOR: T.K. PRASAD, PH.D.
DEPARTMENT: COMPUTER SCIENCE

Cities are composed of complex systems with physical, cyber, and social components. Current work on extracting and understanding city events mainly rely on technology enabled infrastructure to observe and record events. In this work, we propose an approach to leverage citizen observations of various city systems and services such as traffic, public transport, water supply, weather, sewage, and public safety as a source of city events. We investigate the feasibility of using such textual streams for extracting city events from annotated text. We formalize the problem of annotating social streams such as microblogs as a sequence labeling problem. We present a novel training data creation process for training sequence labeling models. Our automatic training data creation process utilizes instance level domain knowledge (e.g., locations in a city, possible event terms). We compare this automated process to a state-of-the-art tool that needs manually created training data and show that it has comparable performance in annotation tasks. An aggregation algorithm is then presented for event extraction from annotated text. We carry out a comprehensive evaluation of the event annotation and event extraction on a real-world dataset consisting of event reports and tweets collected for over four months from San Francisco Bay Area. The evaluation results are promising and provide insights into the utility of social stream for city events.

Co-Authors/Collaborators: Payam Barnaghi, Krishnaprasad Thirunarayan, Ph.D., Amit Sheth, Ph.D.

Adding More Expressivity to Horn Description Logics

Student Presenter(s): Kyle Bayes, Undergraduate Student in Computer Science
FACULTY MENTOR: PASCAL HITZLER, PH.D.
DEPARTMENT: COMPUTER SCIENCE

The Semantic Web (SW), a movement towards making data on the Web more machine readable, has sparked a prolific amount of research in the area. In recent years, the SW has received global attention for its efficiency at searching, organizing, and manipulating large quantities of information on the Web. Description logics (DLs) are fragments of first-order logic that form a core part of the SW. DLs are powerful languages that allow users to formally express knowledge and for expert systems to derive new information from that knowledge. Tableau algorithms are effective procedures for deriving implicit information from explicit stated facts found in a DL database. In our research, we are focusing on the Horn fragment, Horn-SHOIQ, of the expressive DL SHOIQ. We will show how to extend the expressivity of this language by allowing the use of universal constructors in subclass concepts without increasing the time complexity of the tableau algorithm.

Co-Author/Collaborator: David Carral Martinez

KHealth

Student Presenter(s): Surendra Brahma Marupudi, Graduate Student in Computer Science

FACULTY MENTOR: AMIT SHETH, PH.D.

DEPARTMENT: COMPUTER SCIENCE

Mobile devices and sensors are profoundly changing the way we create, consume, and share information. Health aficionados and citizens are increasingly using sensors and devices to track sleep, food, activity, and other physiological observations. This trend is moving toward a paradigm shift of reactive medicine to proactive and preventive medicine. We have built a system called kHealth that is evolving into a proactive and continuous monitoring of observations from Physical, Cyber, and Social domains for health and well-being. kHealth is a knowledge-enabled semantic platform to enhance decision making and improve health, fitness, and well-being. It supports contextual (e.g., condition specific) annotation, integration, and interpretation of sensor and mobile data from individuals using deep domain (e.g., disease) specific knowledge base.

Co-Author/Collaborabor: Cory Pramod

Electrical Engineering

Impact of Interconnections on Performance of RF Designs

Student Presenter(s): Naga Venkata Vijaya Krishna Boppana, Graduate Student in Electrical Engineering
FACULTY MENTOR: SAIYU REN, PH.D.
DEPARTMENT: ELECTRICAL ENGINEERING

This paper presents a technique of designing a good impedance matched Tunable LNA (Low Noise Amplifier) with different types of integrated circuit packages (Flip Chip and Wire Bond packages) using 90nm technology. Current work is on checking the performance of RF design in Wire Bond package. Bond wire is used to connect integrated circuit chip to outside of the world. For low frequency operation, a bondwire acts as a short metal wire which will not affect the performance of the circuit. For Radio Frequency (RF) signals, the bond wire will have parasitic resistance, capacitance and inductance effect to the circuit. A best design circuit may not be able to be tested after fabrication without proper modelling of interconnection bodwire and package to the designed chip. This research is focusing on study of bond wire and package effect to an RF integrated circuit by using Cadence EDA platforms, Viruoso - schematic, Layout editors and Allegro - SiP (System in package), Package and Board designing platforms.

Design and Optimization of a Phase Frequency Detector in 90nm CMOS

Student Presenter(s): Joseph Strzeleki, Graduate Student in Electrical Engineering
FACULTY MENTOR: SAIYU REN, PH.D.
DEPARTMENT: ELECTRICAL ENGINEERING

This project evaluates a novel design using CMOS 90 nm technology for a phase frequency detector in comparison to standard designs. The proposed phase frequency detector is intended for implementation in a phase locked loop signal generator. Power consumption, design complexity, operating deadzone, output stability and linearity, maximum operating frequency, and detection range are considered.

Leadership Studies

Third Grade Reading Guarantee- A Case Study

Student Presenter(s): Adrija Chatterjee, Graduate Student in Clinical Psychology
FACULTY MENTOR: SUZANNE FRANCE, PH.D.
DEPARTMENT: LEADERSHIP STUDIES

In June, 2012, Ohio passed a bill requiring all 3rd graders, with the exception of students with disabilities or English-learners, to pass the state's 3rd grade reading exam before continuing to the 4th grade. In the fall of 2012, Ohio invited LEAs to submit proposals, either individually or as a colloquium, to implement K-3 early literacy and reading interventions that assist in improving reading development and prepare students to read at grade level by the end of 3rd grade. This study investigates the funded implementation of a proposal from a colloquium of three LEAs. A mixed methods design collecting qualitative and quantitative data addresses seven research questions. Qualitative data includes document analyses, interviews, surveys and focus groups with administrators, teachers and parents; quantitative data includes student scores from K-3 level reading skills assessments. A professional learning community among the three LEAs was proposed to provide evidence of the proposal's impact.

Student Growth Measures for Teacher and Principal Evaluations

Student Presenter(s): Allison Mueller, Graduate Student in Counseling
FACULTY MENTOR: SUZANNE FRANCO, PH.D.
DEPARTMENT: LEADERSHIP STUDIES

There were three Ohio research efforts about Student Growth Measures (SGM) for Teacher and Principal Evaluations: 1)extended testing for previously non-tested subjects and grades, 2)relationship between the teacher and principal evaluation systems' implementation plans, and 3) an empirical study of Local Education Agencies' (LEA) year-end evaluation data from 2013. In 2011-2012 Ohio offered a 2 year mini-grant to LEAs agreeing to administer extended testing for Value-Added measures (VAM) in grades and content areas not represented in the Ohio Achievement Assessment (OAA). The mini-grant allowed the state to create testing pools sufficient to produce teacher-level VAMs. American College Testing (ACT) End of Course (EOC), Terra Nova, MAPS, and/or Star assessments were administered. The two year study of a sample of 23 funded LEAs has provided findings for the local and national discussions about student growth measures and teacher/principal evaluations. At the same time Ohio completed a case study for a sample of 22 LEAs about the relationship between OTES/OPES implementation. And finally, 21 LEAs' final 2013 teacher and principal evaluation data were analyzed for general trends.

Marketing

An Empirical Study of Consumers' Attitudes and Behaviors Toward Showrooming

Student Presenter(s): Hanna Ranly, Undergraduate Student

FACULTY MENTOR: POLA GUPTA, PH.D.

DEPARTMENT: MARKETING

Showrooming occurs when customers go into stores, look at products, and then buy online, often for a cheaper price. Our research is going into the aspects of Showrooming and how it impacts businesses. We are also researching ways in which businesses can combat this practice. The survey asks respondents if they showroom, how often, for what reasons, what kinds of products, what stores, among many other questions. Dr. Gupta and I would like to see what people say about Showrooming and if the practice is different between students and non-students.

Mathematics and Statistics

Balanced Perfect Sequences of Even Period

Student Presenter(s): Hamza Abdel-Latif, Undergraduate Student in Mathematics
FACULTY MENTOR: K.T. ARASU, PH.D.
DEPARTMENT: MATHEMATICS AND STATISTICS

Let “a” be a binary sequence (a_i) of period n for i>=0, so a_i is in {+1,-1} and a_(i+n) = a_i for each i. The autocorrelation of a binary sequence (a_i) for shift t is defined as the following:

C_t(a) = a_(0)*a_(0+t) + a_(1)*a_(1+t) + ... + a_(n-1)*a_(n-1+t)

A sequence a with a constant C_t(a) for all possible shifts t , i.e. 0 < t <= n – 1, is said to have constant autocorrelation. It is well known from [6] that C_t(a) is congruent to n (mod 4).

It is important to find such sequences that are perfect (i.e. have optimal autocorrelation). A perfect sequence a has the smallest possible max (0 < t <= n-1) |C_t(a)|. Thus, we wish to have sequences with the following autocorrelations for every t not congruent to 0 (mod n):
C_t(a) = 0, if n is congruent to 0 (mod 4)
C_t(a) = 1, if n is congruent to 1 (mod 4)
C_t(a) = +-2, if n is congruent to 2 (mod 4)
C_t(a) = -1, if n is congruent to 3 (mod 4)

We provide an overview of the known families of perfect binary sequences of period 2 (mod 4). We present previously unknown examples of balanced perfect binary sequences of period 38 and 50, due to computer results. We also provide a new example for length 62, though it is not balanced.

Showing Nonexistence of Certain Circulant Weighting Matrices

Student Presenter(s): Kyle Bayes, Undergraduate Student in Computer Science
FACULTY MENTOR: K.T. ARASU, PH.D.
DEPARTMENT: MATHEMATICS AND STATISTICS

One aspect of combinatorics is the study of designs that obey a sense of balance and symmetry. A particular combinatorial design is a circulant weighing matrix. A circulant weighing matrix CW(n,k) is a n x n square matrix such that the first row has entries from the set {-1,0,1}, each row, except the first row, is a cyclic shift to the right of the preceding row, and the product of the matrix multiplied by its transpose is k*I, where I is the identity matrix. We will show that there does not exist such matrices for CW(88,81) and CW(99,81), which their statuses have been unknown for some time. By viewing these matrices as elements in a group ring, we will use counting methods to show the nonexistence of the CW(88,81) case, and we will use methods from group representation theory to show the nonexistence of the CW(99,81) case.

Co-Authors/Collaborators: Ali Nabavi and K.T. Arasu, Ph.D.

Entropy Optimal Orthogonal Matrices

Student Presenter(s): Jacob Erickson, Undergraduate Student in Mathematics
FACULTY MENTOR: K.T. ARASU, PH.D.
DEPARTMENT: MATHEMATICS AND STATISTICS

An alternate definition of entropy, applying to orthogonal matrices, is defined. Furthermore, the relation between entropy optimization and the construction of Hadamard matrices is explored, touching on applications and numerical results. The presentation concludes with a brief discussion of the usage of Lie groups to facilitate optimization in current research.

Co-Authors/Collaborators: Akhilesh Pathak, Ramya Ramachandran Janaki, K.T. Arasu, Ph.D.

On Difference Set Pairs in Abelian Groups

Student Presenter(s): David Hilton, Graduate Student in Mathematics

FACULTY MENTOR: K.T. ARASU, PH.D.

DEPARTMENT: MATHEMATICS AND STATISTICS

Binary array pairs with optimal/ideal correlation values and their algebraic counterparts "difference set pairs" (DSPs) in abelian groups are studied. In addition to generalizing known 1-dimensional (sequences) examples, we provide some new recursive constructions, unifying previously obtained ones. Any further advancement in the construction of binary sequences/arrays with optimal/ideal correlation values (equivalently cyclic/abelian di_er- ence sets) would give rise to richer classes of DSPs (and hence binary perfect array pairs). Discrete signals arising from DSPs find applications in cryptography, CDMA systems, radarand wireless communications.

Neuroscience, Cell Biology and Physiology

Placental-Specific Prolonged Activity of Hypoxia-Inducible Factor 1 alpha (HIF-1α): A Mouse Model of Preeclampsia

Student Presenter(s): Renee Albers, Graduate Student in Biomedical Sciences
FACULTY MENTOR: THOMAS L. BROWN, PH.D.
DEPARTMENT: NEUROSCIENCE, CELL BIOLOGY AND PHYSIOLOGY

Pregnancy-Associated Disorders occur as a result of inappropriate placental development. Preeclampsia, which occurs in 5-8% of all births, is characterized by maternal hypertension, proteinuria, low birth weight, and premature birth. Previous studies have shown that oxygen is an important mediator of placental cell differentiation. Hypoxia inducible factor-1 alpha (HIF-1α) is a critical component of the cellular oxygen-sensing machinery and is essential for placental formation and embryonic survival.

In order to investigate the role of HIF-1α during embryonic and placental development, we caused prolonged placental activity of HIF-1α, by using a form of HIF-1α that is insensitive to oxygen, denoted as CA-HIF-1α. In order to have continual placental specific activity of CA-HIF-1α, lentiviral infection was performed on embryos at the blastocyst stage of development and transferred into pseudopregnant mothers. To determine if prolonged activity of HIF-1α, strictly affecting the placenta can cause preeclampsia, we analyzed maternal blood pressure through-out the pregnancy. Additionally, placental morphology, pup weight, placental weight, and time of birth were recorded and analyzed. The data indicate that prolonged activity of HIF-1α, specifically in the placenta, causes increased maternal blood pressure that returns to baseline after delivery, decreased birth weight offspring, and disruption of proper placental development, which supports the use of this system as a mouse model of human preeclampsia.

Co-Authors/Collaborators: Melissa R. Kaufman, Chanel Keoni, Savannah Doliboa, Martha Hughes, Bryony Natale, David Natale, Ph.D. and Thomas L. Brown, Ph.D.

AMPK Knockdown in Placental Trophoblast Cells Results in Altered Morphology and Function

Student Presenter(s): Renee Albers, Graduate Student in Biomedical Sciences
FACULTY MENTOR: THOMAS L. BROWN, PH.D.
DEPARTMENT: NEUROSCIENCE, CELL BIOLOGY AND PHYSIOLOGY

The placenta is a transient organ that develops upon the initiation of pregnancy and is essential for embryonic development and fetal survival. The rodent placenta consists of distinct lineages and includes cell types that are analogous to those that make up the human placenta. Trophoblast cells within the labyrinth layer, which lies closest to the fetus, fuse and come in contact with maternal blood, thus facilitating nutrient and waste exchange between the mother and the baby. Abnormalities of the placenta may occur as a result of cellular stress and have been associated with Pregnancy-Associated Disorders: such as preeclampsia, intrauterine growth restriction, and placental insufficiency. Cellular stress has also been shown to alter proliferation and differentiation rates of trophoblast cells. This stress response is important for cell survival and ensures continued placental functionality. AMP-activated protein kinase (AMPK) is an important sensor of cellular metabolism and stress. To study the role of AMPK in the trophoblast cells, we used RNA interference to simultaneously knockdown levels of both of the AMPK alpha isoforms, AMPKα1 and

AMPKα2. SM10 trophoblast progenitor cells were transduced with AMPKα1/2 shRNA and stable clones were established to analyze the effects of AMPK knockdown on important cellular functions. Our results indicate that a reduction in AMPK levels causes alterations in cell morphology, growth rate, and nutrient transport, thus identifying an important role for AMPK in the regulation of placenta trophoblast differentiation.
Co-Authors/Collaborators: Erica A.K. Carey, Savannah R. Doliboa, Martha Hughes, Christopher N. Wyatt, Ph.D., David R.C. Natale, Ph.D., Thomas L. Brown, Ph.D.

Anatomical Investigations of Saphenous Nerve Afferent Terminations in the Postnatal Mouse Spinal Cord

Student Presenter(s): Marisela Dallman, Graduate Student

FACULTY MENTOR: DAVID LADLE, PH.D.
DEPARTMENT: NEUROSCIENCE, CELL BIOLOGY AND PHYSIOLOGY

The somatosensory system relays and processes information about a number of sensory modalities including, mechanoception (touch), thermoception (temperature), nociception (pain), and proprioception (body position), which are crucial to understanding our external environments. Cutaneous (touch, temperature, pressure), proprioceptive, and nociceptive receptors receive and thus, instigate the transmission of sensory information to the central nervous system (spinal cord and brain) where it will ultimately be translated into a specific response. Cutaneous sensory information travels by way of sensory afferent nerves (nerves that conduct signals in the direction of the CNS) to the spinal cord where they terminate in the dorsal horn. Proprioceptive afferents transmit proprioceptive information to the spinal cord in a similar fashion; however they terminate in the ventral horn of the cord where they can make direct synaptic (monosynaptic) connections with motor neurons. The saphenous nerve is traditionally classified as exclusively a cutaneous sensory nerve. Electrophysiological studies in our laboratory however, have revealed small-scale, yet consistent monosynaptic reflexes suggesting that a subgroup of these sensory afferents may in fact be directly contacting motor neurons in the ventral horn of the spinal cord. The present study aims to characterize and localize these sensory afferents using retrograde tracing, immunohistochemical techniques, and confocal analysis. Parvalbumin (PV), a calcium binding protein which is expressed by all proprioceptive sensory axons, was used to differentiate proprioceptive from cutaneous afferents. Experiments were done using an in vitro spinal cord preparation from early postnatal wild-type mice (P0-P2, n=3). In each animal, axon branches of PV negative saphenous axons were observed in the ventral horn consistent with our electrophysiological findings. Current and future experiments will aim to expand our knowledge and understanding of the anatomical and physiological functions of these novel axons.
Co-Authors/Collaborators: Marisela A. Dallman, Patrick M. Sonner, Ph.D., David R. Ladle, Ph.D.

Na+ Entry Through TRPM7 Channels

Student Presenter(s): Siham Hourani, Graduate Student

FACULTY MENTOR: JULIUSZ ASHOT KOZAK, PH.D.
DEPARTMENT: NEUROSCIENCE, CELL BIOLOGY AND PHYSIOLOGY

TRPM7 is a Ca2+/Mg2+ permeable ion channel highly expressed in immune cells. Like many other TRP superfamily members, it conducts physiologically important monovalent cations Na+ and K+. Na+ influx through most TRP channels has not been measured directly, however. We set out to quantify Na+ influx through TRPM7 channels by using fluorescence microscopy and SBFI ratiometric Na+ indicator dye in HEK293 cells overexpressing mTRPM7. Kv1.3 was co-expressed in order to make the membrane more hyperpolarized. In the presence of divalent cations TRPM7 current is strongly outwardly rectifying, and in their

absence becomes semi-ohmic with a large inward component. In TRPM7-expressing HEK cells, removal of external divalents resulted in consistently steep increases in intracellular Na+ signal detected by SBFI. Spermine blocks monovalent TRPM7 currents with IC50 of 2 µM. Accordingly, Na+ flux was reduced by ~50% when 3 µM spermine was included in the divalent-free buffer. Higher spermine concentrations (10 and 30 µM) resulted in progressively stronger inhibition of Na+ flux. Similar results for free Mg2+,which dose-dependently reduced Na+ flux at 31, 62 and 100 µM, suggested that Na+ flux occurs through TRPM7 channels. The phenolic compound carvacrol, previously reported to be a blocker of TRPM7 channels, potently suppressed the Na+ signal at 150 µM but not at 30 µM. In TRPM7-overexpressing cells, switching from no divalents to a 100 mM Ca2+ containing buffer caused Ca2+ elevation, measured by Fura-2, but it was not significantly different from control untransfected HEK cells. Cytoplasmic alkalinization, which activates TRPM7 channels, was effective in increasing the Na+ flux through these channels. Na+ flux could also be measured in Jurkat T cells, which express TRPM7 and Kv1.3 channels endogenously. The presented Na+ flux assay will be useful for measurement of TRPM7 channel activity in intact cells.
Co-Authors/Collaborators: Pavani Beesetty, Masayuki Matsushita and J. Ashot Kozak, Ph.D.

Site Directed Mutagenesis of a Lentiviral NdeI Restriction Site

Student Presenter(s): Kirsten Jacobson, Graduate Student
FACULTY MENTOR: THOMAS L. BROWN, PH.D.
DEPARTMENT: NEUROSCIENCE, CELL BIOLOGY AND PHYSIOLOGY

The human U6 promoter is an RNA polymerase III (pol III) promoter used to drive the expression of short hairpin RNAs (shRNAs), which silence target genes. Expression using Pol III promoters is optimal for producing global shRNA knockdown because of their precise initiation and termination of transcription; however, they lack the spatial and temporal control necessary for tissue-specific knockdown. RNA polymerase II promoters, on the other hand, have the capability driving tissue specific expression. The purpose of this study is to determine if the RNA Polymerase II promoter, CMV, can drive shRNA knockdown comparable to the RNA polymerase III promoter, U6. If comparable knockdown occurs between the two promoters, a tissue-specific RNA polymerase II promoter can be used in place of the CMV promoter, allowing for tissue-specific knock down of a target gene. To clone and compare knockdown between the two promoters, the NdeI restriction enzyme site in the CMV promoter must be mutated to allow for future cloning steps and insertion of shRNAs. If comparable levels of knockdown occur then it demonstrates that we can manipulate the CMV promoter to use tissue and cell specific promoters. To create the initial construct, a lentiviral green fluorescent protein, Lv-CMV-GFP-V5 was used. A single NdeI restriction site in the CMV promoter had to be mutated for future cloning steps and the insertion of shRNAs. To ensure that disruption of the NdeI restriction site did not alter the critical capability of the promoter, we first identified the minimal CMV promoter region. In addition, we performed Transfac analysis to ensure that no crucial transcription factor binding sites were present within the NdeI site. Our initial site directed mutant (SDM) primers were designed to replace the NdeI site with a new Kpn I restriction site. On further analysis, our inability to obtain a site directed mutant may be have been related to a cruciform structure surrounding the NdeI during the polymerase chain reaction. Three new SDM primers sets were generated that eliminated the potential for cruciform formation. SDM of these primers resulted in the successful mutation of the NdeI, as confirmed by DNA sequencing; however subsequent analysis of the GFP protein indicated that functional GFP activity was completely eliminated in the new Nde I mutants. Our future goal is to redesign SDM primers that mutate the NdeI

site but do not mutate a potentially a cryptic ATG start site (within the NdeI site itself), that may be required for functional activity.
Co-Authors/Collaborators: Melissa Kaufman, Savannah Doliboa, and Thomas L. Brown, Ph.D.

Stroke Physical Rehabilitation: Impact on Motor Functional Recovery in Drug Treated Versus Vehicle Treated Rats

Student Presenter(s): Moner Ragas, Graduate Student in Biological Sciences
FACULTY MENTOR: ADRIAN M. CORBETT, PH.D.
DEPARTMENT: NEUROSCIENCE, CELL BIOLOGY AND PHYSIOLOGY

Introduction: Post-stroke physical rehabilitation has been considered essential for enhancing motor functional recovery. In this study, adult female Sprague-Dawley rats were subjected to cerebral ischemic stroke induced by endothelin-1 (ET-1), then treated using either a unique drug combination of 5 mg/kg Fluoxetine and 1 mg/kg Simvastatin or a vehicle control beginning 6-12 hours after stroke induction. On post-stroke day 8, the rats were subjected to voluntary physical rehabilitation every other day for a period of five and half weeks.
Purpose: The aim of this study is to determine whether physical rehabilitation might enhance motor functional recovery in drug-treated versus vehicle-treated rats.
Results: In drug-treated rats, both rehabilitated and non-rehabilitated groups showed a 34% recovery in contralateral limb function; whereas, in vehicle-treated rats, animals who underwent physical rehabilitation showed a mean of 26% recovery in contralateral limb function versus 8.6% recovery in non-rehabilitated ones, which were both significantly different from drug-treated groups. On the other hand, the ipsilateral limb of non-rehabilitated (control and drug-treated) rats showed a significant (~23% versus -0.1%) difference in recovery from rehabilitated rats; there was also a significance difference in the baseline ipsilateral deficit between rehabilitation and non-rehabilitation groups which may help explain this statistical difference in the ipsilateral limb recovery. The starting time for drug delivery may have negatively influenced the functional recovery. The early delivery (6-12 hours after stroke induction) of this drug combination resulted in a larger infarct size than had previously been seen when this drug treatment was delivered beginning 20-26 hours after stroke induction. Early delivery of the drug combination may result in secondary hemorrhagic stroke.
Conclusion: This study proves that our post-stroke drug combination treatment allows for motor functional recovery in those individuals for whom physical rehabilitation may not be possible, giving slightly better motor recovery in grasping.
Co-Authors/Collaborators: Maria Balch, Amber Hensley, Kenney Reynolds, Danny Wright, Bryce Kerr and Adrian M. Corbett, Ph.D.

Lentiviral Gene Targeting

Student Presenter(s): Mellssa Sands, Undergraduate Student
FACULTY MENTOR: THOMAS L. BROWN, PH.D.
DEPARTMENT: NEUROSCIENCE, CELL BIOLOGY AND PHYSIOLOGY

Lentivirus is becoming a more widely used gene transfer system due to its ability to integrate into the host genome and provide stable gene expression. One advantage of this system includes having ubiquitous gene expression in the embryo and placenta by infection at the two-cell to eight-cell stage of the embryo. Alternatively, we can direct placental-specific expression by infection exclusively at the blastocyst stage of the embryo. Development of cell-specific promoters will allow even greater selectivity for future analysis. This method of gene transfer should prove highly useful in many different applications from studying placental abnormalities to the induction or prevention of numerous diseases.
Co-Authors/Collaborators: Renee E. Albers, Melissa R. Sands, Thomas L. Brown, Ph.D.

Prolonged Expression of Hypoxia-Inducible Factor 1 alpha (HIF-1α) in the Placenta Leads to Placental Abnormalities

Student Presenter(s): Melissa Sands, Undergraduate Student
FACULTY MENTOR: THOMAS L. BROWN, PH.D.
DEPARTMENT: NEUROSCIENCE, CELL BIOLOGY AND PHYSIOLOGY

Hypoxia-inducible factor-1 alpha (HIF-1α) is a critical component of the cellular oxygen-sensing machinery and is essential for placental formation and embryonic survival. In this study, we caused prolonged placental expression of HIF-1α, by using a form that is insensitive to oxygen, denoted as CAHIF-1α. In order to have continual placental specific expression of the CAHIF-1α, lentiviral infection was performed on embryos at the blastocyst stage of development and transferred into pseudopregnant mothers. Placental analysis was performed via in situ hybridization on embryonic day 14.5 (E14.5) to determine the effects of CAHIF-1α prolonged expression. In order to detect placental abnormalities and disorganization, specific cell markers for each of the placental lineages were used in the hybridization. Data indicate that prolonged activity of CAHIF-1α, restricted to trophoblast cells in the mouse placenta, results in changes to placental architecture, failure of trophoblasts to remodel the maternal arteries, and inability of cells to advance from their progenitor states. Since HIF-1α has the ability to cause developmental placental disruption, its regulation could be key in multiple pregnancy related disorders such as pre-eclampsia and intrauterine growth restriction (IUGR).

Co-Authors/Collaborators: Renee E. Albers, Melissa R. Kaufman, Martha Hughes, Bryony Natale, David Natale, Thomas L. Brown, Ph.D.

Channelopathy Contributes to Proprioceptive Deficits Following Chemotherapy

Student Presenter(s): Krystyna Wieczerzak, Graduate Student
FACULTY MENTOR: TIMOTHY C. COPE, PH.D.
DEPARTMENT: NEUROSCIENCE, CELL BIOLOGY AND PHYSIOLOGY

Among the neurotoxic effects of oxaliplatin (OX) our recent in vivo studies (Bullinger et al., J. Neurophysiol. 2011) of rat demonstrated abnormalities in sensory encoding by muscle proprioceptors. For many weeks following IP OX injection, primary muscle spindle afferents (IA) lost their ability to fire during sustained muscle stretch, i.e. they became rapidly adapting. We speculated that the loss of sustained firing was related to some effect of OX on persistent inward currents (PICs) involved in either transduction or encoding.

In the present study, we test this idea by examining the effects of pharmacologically blocking PICs in terminal experiments performed on isoflurane-anesthetized normal adult wistar rats. Action potentials were recorded intra-axonally from muscle proprioceptors in response to muscle stretch. After sampling several afferents under these conditions we injected (ip) one of two anti-epileptic agents (riluzole or phenytoin), which are known to block PICs among other effects. Each of these agents reproduced the previously described effects of OX. Specifically, firing during the hold phase of stretch was significantly shortened. Action potential encoding during the ramp phase of stretch and during vibration was unaltered as it was during OX treatment. These observations suggest that OX neurotoxicity targets specific ion channels and encoding features. In separate studies, we've begun to examine motor behaviors which may be expected to be altered by the impairment described above for proprioceptors. Rats were treated as described above with OX and a variety of measures were made to assess the systemic effects of OX together with the animals ability to walk on a balance beam. Declines in tail SNAPs (sensory nerve

action potentials) and lack of response to distal tail pinch indicated the presence of some neuropathy. The rats exhibited the balance beam, OX -treated rats showed 50% slips and missed steps. Treated rats also exhibited errors in achieving support as the hindlimb reached for the balance beam after a slip. This disability did not seem to be explained by a loss of touch sensation. Future studies are planned to more directly relate motor disability with proprioceptor dysfunction. We also will assess whether the anti-epileptic drugs, which are known to cause ataxia, result in motor disability resembling that observed with OX. These results could have important implications for understanding and possibly treating the persistent proprioceptive dysfunction experienced by patients treated with OX.
Co-Authors/Collaborators: Timothy C. Cope, Ph.D., Paul Nardelli, Mark M. Rich, Ph.D., and Jacob A. Vincent.

Changes in C-bouton Synapses During ALS Progression

Student Presenter(s): Aouatef Chihi, Undergraduate Student in Biomedical Engineering
FACULTY MENTOR: SHERIF ELBASIOUNY, PH.D.
DEPARTMENT: NEUROSCIENCE, CELL BIOLOGY AND PHYSIOLOGY

Each year, about 5,600 people in the United States are diagnosed with Amyotrophic Lateral Sclerosis (ALS). Their average life expectancy is between two to five years from the time of diagnosis. ALS is a neurological disease targeting upper and lower motor neurons innervating muscle fibers, causing their progressive degeneration and eventually paralysis. Computer modeling of diseased versus non-diseased motoneurons in our laboratory has suggested that calcium-dependent potassium channels(SK)are involved in early ALS pathogenesis.Because cholinergic boutons (called C-boutons) co-localize with SK channels on motoneurons, it is then expected that C-boutons might also undergo pathological changes that contribute to disease pathogenesis. Therefore, the purpose of this study is to examine the distinctive failure in walking on the balance beam, whereas untreated rats exhibited virtually 100% success in foot placement on changes in C-boutons during ALS progression in transgenic SOD1G93Amice. At various ages (10, 30,50,and 90 postnatal days), and after death, the spinal cord is extracted from the lumbar and sacral regions. Following perfusion and immunohistochemistry staining, the tissue is imaged using confocal microscope. Analysis of images is done by measuring the area and perimeter of motoneurons' soma, as well as the areas and the immuno expression intensities of C-boutons and SKchannels.Preliminary data show that SK channel expression in transgenic mice is less than that in age-matched wild type mice, and their number and characteristics are changing with the progression of the disease. These data confirm the computer model predications and might provide new insights into ALS pathogenesis.
Acknowledgement: Funding to A.C. was obtained through the NIH/NIGMS, R25GM090122, IMSD BioSTAR. Funding to S.M.E. was obtained through the University System of Ohio Research Initiative.
Co-Authors/Collaborators: Andrew Clark, Allison Colvin, Kerry Hart, Shannon Romer, Sherif Elbasiouny, Ph D.

The Effect of SK Channel Modulation on Survival and Motor Performance of ALS Mice

Student Presenter(s): Basia Galinski, Graduate Student

FACULTY MENTOR: SHERIF ELBASIOUNY, PH.D.

DEPARTMENT: NEUROSCIENCE, CELL BIOLOGY AND PHYSIOLOGY

Amyotrophic lateral sclerosis (ALS), also known as Lou Gehrig's disease, is a fatal neurodegenerative disease that has debilitating effects on the patient and has no cure or treatment. Riluzole, the only FDA approved drug, can only extend the patient's survival by 3 months. Computer modeling of diseased versus non-diseased motoneurons in our laboratory has proposed SK channels as a new potential target that play an important role in ALS pathogenesis. There are several mouse models that are used to study ALS but this study uses the SOD1G93A transgenic mouse model for the experiments. This mouse model is the most characterized and studied of mice lines and is known for its aggressive disease progression. The purpose of this study is to target SK channels pharmacologically with drugs that either enhance (e.g., CyPPA) or block (e.g., Apamin) their activation and examine the drugs effects on survival and motor performance of treated versus untreated transgenic mice. In separate groups, drug injections were given daily between five days post birth (P5) and P11 (total of 7 days), a time period that has been shown to be a critical period for disease pathogenesis. The motor performance of mice was then tested using the rotarod and open field tests every five days starting at P50 (before symptoms emerged) until end stage (when mice died by the disease). This is an ongoing study and all the data presented are preliminary.

Co-Authors/Collaborators: Saihari Dukkipati, Sherif M. Elbasiouny, Ph.D.

Pharmacology and Toxicology

Effect of TCDD on Immunoglobulin Class Switching

Student Presenter(s): Naga Lakshmi Kaulini Burra, Graduate Student
FACULTY MENTOR: COURTNEY SULENTIC, PH.D.
DEPARTMENT: PHARMACOLOGY AND TOXICOLOGY

2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) is a potent and persistent environmental toxin known to inhibit immunoglobulin (Ig) gene expression in various animal studies. It has been proved in many animal and human studies that the effects of TCDD are mediated through Aryl hydrocarbon receptor (AhR), a nuclear receptor present in the cells that regulates the xenobiotic metabolizing enzyme, *CYP450* and a subsequent alteration in the gene expression. The mouse 3'*Igh* regulatory region (3'*Igh*RR) is sensitive transcriptional target of TCDD that may mediate the inhibition of Immunoglobulin expression and class switch recombination. Suppression of antibody production in response to TCDD in animal models suggests that human B cells could also be a sensitive target of TCDD but, very few studies have evaluated the effect of TCDD on human B cell function and Ig expression and none of them have evaluated the human *3'IghRR*. Based on preliminary data in our lab, we hypothesize that TCDD activated AhR inhibits Ig expression by interacting with the 3'*Igh*RR. Immunoglobulin class switching provides the basis for the versatile humoral immune functions of Ig molecules. Class switching mainly occurs through a DNA recombination event resulting in the excision of a DNA region between a switch site just upstream of the mu constant region and a switch site just upstream of the Igh constant region targeted for expression. This process is known as Ig class switch recombination (CSR). Germline transcription precedes class switching, which targets a specific constant region and opens the chromatin for CSR. The CL-01 cells can be activated to express IgM and IgG by ligands for the Toll-like receptors TLR7/8 and TLR9, and this activation appears to be sensitive to TCDD. The aim of my study is to determine the relationship between the AhR, germline transcription and CSR. In this current study, a Reverse Transcription PCR would be used to identify the germline and functional transcripts and a Nested PCR to identify the switch circles. A competitive AhR Antagonist (CH-223191) will be employed to determine the role of AhR in class switching. Preliminary data supports the functional role of AhR in the CL-01 cells (Human B Lymphocyte). Current studies could help understand the role of TCDD activated AhR in the class switching and antibody production in human cell line. (Supported by NIEHS R01ES014676)

Elucidating the Role of the Polymorphic Human hs1,2 Enhancer in the Effects of TCDD

Student Presenter(s): Abdullah Freiwan, Graduate Student in Biological Sciences
FACULTY MENTOR: COURTNEY SULENTIC, PH.D.
DEPARTMENT: PHARMACOLOGY AND TOXICOLOGY

2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) is a potent environmental toxin known to inhibit immunoglobulin (Ig) gene expression in various animal studies. We have identified the mouse 3'Ig heavy chain regulatory region (3'*Igh*RR) as a sensitive transcriptional target of TCDD, which may mediate the inhibitory effect of TCDD on Ig expression. Interestingly, the human hs1,2 enhancer is polymorphic and has been associated with a number of autoimmune diseases. Suggesting a species difference, TCDD inhibited mouse hs1,2 enhancer activation and activated basal human hs1,2 (hs-hs1,2) enhancer activity. The objective of this study was to determine the effect of stimulation and TCDD on hu-hs1,2 enhancer activity using a human B-cell line (CL-01) and luciferase reporter constructs regulated by each of the human hs1,2 alleles. Our results

verity that TCDD alone activates each of the hu-hs1,2 alleles. Surprisingly, B-cell stimulation through TLR 7 and 8 by R848 inhibited basal activity of the hu-hs1,2 alleles and TCDD co-treatment reversed this inhibition. In contrast, R848 induced Ig secretion and activated a 3x NF-κB luciferase reporter, therefore confirming functional signaling through the TLRs and activation of the CL-01 B-cell line. R848 also induced class switch recombination from IgM to IgG. Furthermore, TCDD inhibited both IgM and IgG secretion in cells stimulated with R848. These results suggest that the hu-hs1,2 enhancer may be a negative regulator of 3'*Igh*RR activity and Ig expression. Alternatively, the hs1,2 enhancer may function differently when studied in isolation as compared to its function in the intact 3'*Igh*RR. Future studies will evaluate the effect of TCDD in the absence or presence of stimulation on the activity of the entire human 3'*Igh*RR and its other enhancers, hs3 and hs4. Elucidating the role of the polymorphic hs1,2 enhancer in 3'*Igh*RR activity and the effect of TCDD on the enhancers of the 3'*Igh*RR may provide insights into the etiology of autoimmune diseases associated with the hs1,2 polymorphism. (Supported by NIEHS R01ES014676)

Co-Authors/Collaborators: Brooke Johnson and Courtney Sulentic, Ph.D.

Increased Urinary Angiotensin Converting Enzyme 2 (ACE2) in Diabetic patients with CKD

Student Presenter(s): Sridevi Gutta, Graduate Student in Pharmacology and Toxicology

FACULTY MENTOR: KHALID M. ELASED, PH.D.

DEPARTMENT: PHARMACOLOGY AND TOXICOLOGY

Type 2 diabetes and its associated chronic Kidney Disease (CKD) have become a major health burden. CKD is associated with tenfold increase in cardiovascular mortality and risk multiplayer in hypertensive and diabetic patients. There is a need for new sensitive biomarker for detection and monitoring CKD since albuminuria may be nonspecific and insensitive. Angiotensin converting enzyme 2 (ACE2) is highly expressed in renal tubules and has been proposed to be renoprotective. ACE2 is a monocarboxy peptidase mediating degradation of angiotensin (Ang) II. The aim of the study is to investigate the association between urinary ACE2 and incidence or progression of CKD at early stages among individuals with type 2 diabetes. Participants were recruited at the Dayton VA Medical Center. These participants were aged 40 years or older. Using Western blot and ACE2 enzyme activity, we investigated ACE2 shedding in urine samples from 20 nondiabetic individuals with no history of renal disease and 40 diabetic patients with various levels of albuminuria (normoalbuminuria, microalbuminuria and macroalbuminuria). There was no evidence of ACE2 in the urine of nondiabetic individuals as measured with fluorogenic ACE2 enzyme activity. However, there was a significantly increased urinary ACE2 activity in diabetic microalbuminuric patients compared to macroalbuminurics and nondiabetic individual ($p<0.05$). Using western blot, we also detected ACE2 immunoreactive bands (≈ 120KDa, ≈70 KDa and ≈ 50 KDa) in urine of diabetic patients. In addition, urinary ACE2 was detected in normoalbuminuric patients with history of microalbuminuria. In conclusion, the present study identified a significant difference in urinary ACE2 between diabetic patients with history of microalbuminuria and non-diabetic subjects suggesting that urinary ACE2 could be used as an early, noninvasive biomarker for early stage of CKD.

Co-Authors/Collaborators: Nadja Grobe, Ph.D., Hassan Osman, Mohammad Saklayan, Khalid M. Elased, Ph.D.

The Effects of Exercise and Metformin on Monoamine Activity in db/db Mice

Student Presenter(s): Marie Heis, Undergraduate Student in Biological Sciences

FACULTY MENTOR: JAMES LUCOT, PH.D.
DEPARTMENT: PHARMACOLOGY AND TOXICOLOGY

Diabetes is a disease that continues to grow more common. Recent studies have shown a correlation between psychiatric disorders and type II diabetes (T2D), which is the most common form of diabetes. A first line drug to treat T2D is metformin (biguanide class), which controls the amount of glucose circulated within the blood. Exercise is a well-known, common treatment for both mental health disorders and T2D. This study was designed to determine if exercise, metformin or their combination affects monoamine function within different brain areas of mice with a T2D phenotype. The db/db mice had a lower dopamine (DA) use in the caudate and accumbens as measured by the HVA (homovanillic acid)/ DA ratio. This result is consistent with decrease in motor activity previously reported in these subjects. The db/db mice had lower 5-HT (serotonin) use (5-HIAA-5-HT) and higher norepinephrine concentrations in the amygdala. This could account for the increased thigmotaxis in db/db mice, in which the mice had greater aversion to the open area and remained close to the relative safety of the walls. In addition, the db/db mice have decreased dopamine usage in the frontal cortex. There was no memory test performed to determine abnormalities in this behavior. Metformin decreased DA and 5-HT use in the caudate. However, this did not correspond to any specific behavioral effect. In parts of the brain there was significance that showed motor activity deficits and in other parts of the brain showed thigmotaxis. Otherwise there were very few effects of either treatment on any of the brain areas or on behavior.

Co-Authors/Collaborators: Teresa Garrett, Gregory Boivin, D.V.M., Hari Somineni, Elased Khalid, Ph.D., James Lucot, Ph.D.

The Mechanism of Aryl Hydrocarbon Receptor in the Human Immunoglobulin Heavy Chain

Student Presenter(s): Bassam Kashgarl, Graduate Student in Microbiology and Immunology

FACULTY MENTOR: COURTNEY SULENTIC, PH.D.
DEPARTMENT: PHARMACOLOGY AND TOXICOLOGY

The Aryl Hydrocarbon Receptor (AhR) is a cytosolic transcription factor ligand-activated that regulates xenobiotic-metabolizing enzymes. It's the most well known for mediating the toxic effects of 2,3,7,8-tetracholorodibenzo-p-dioxin (TCDD), which inhibits the differentiation of B-cells into antibody-secreting cells, and inhibits the Immunoglobulin (Ig) expression. We previously have determined that TCDD-induced inhibition in mouse immunoglobulin heavy chain (mo-Igh) is mediated by AhR-dependent inhibition of 3' Immunoglobulin heavy chain regulatory region gene (3'*Igh*RR), and that inhibit the capacity of the 3'*Igh*RR to increase the expression of Ig. The disruption of the AhR pathway reversed that inhibition. However, in humans, the 3'*Igh*RR is duplicated, and its structure is little different. The mouse 3'*Igh*RR contains 4 enhancers (hs3A; hs1,2; hs3B; and hs4), where as in human is has 3 enhancers only (hs3A; hs1,2; and hs4). The hs 1,2 is known to be highly polymorphic in human, and it's associated with autoimmune diseases. Finding out the mechanism by which the AhR mediates TCDD in human can lead to significant therapeutic implications for the related immune diseases.

Functional Expression of KCC3 in Human Embryonic Kidney (HEK-293) Cells

Student Presenter(s): Nagendra Babu Ravilla, Graduate Student in Pharmacology and Toxicology

FACULTY MENTOR: NORMA ADRAGNA-LAUF, PH.D.
DEPARTMENT: PHARMACOLOGY AND TOXICOLOGY

K-Cl cotransport (KCC) is mediated by four protein isoforms, KCC1 to KCC4, and plays a significant role in cell volume regulation and in K and Cl homeostasis. In this study, we demonstrate the importance of KCC3 and its two threonine (T) phosphorylation sites. T991 and T1048 in cellular K homeostasis in isogenic human embryonic kidney (HEK-293) cells transfected with KCC3 wild type (WT) or constitutively active double mutant KCC3 (AA) expressed under tetracycline control. In both WT and AA cells, under baseline conditions, the Na-K-2Cl cotransport (NKCC) was the major contributor of Rb influx (55 %- 60 %), followed by the Na/K pump (NKP) (35 % - 40 %) and KCC (10 % - 15 %) whereas the absolute values of Rb influx were higher in AA cells. Doxycycline induction had no effect on either NKCC or KCC in WT cells, whereas NKCC was completely inhibited and KCC was increased by 25 fold in AA cells. In AA cells, intracellular K (Ki) decreased by 90 % upon doxycycline induction in Cl medium and 50 % of this loss was attenuated in Cl-free (sulfamate replacement) medium. Doxycycline-induced Cl-dependent Ki loss was sensitive to furosemide (2 mM) but insensitive to tetra ethyl ammonium (TEA) (2 mM), whereas doxycycline-induced Cl-independent Ki loss was sensitive to 4-(2-butyl-6, 7-dichloro-2-cyclopentylindan-1-on-5-yl) oxybutyric acid (DCPIB) (50 µM) but insensitive to TEA (2 mM), furosemide (2 mM). We conclude that KCC3 is important for K and volume homeostasis.

Co-Authors/Collaborators: Peter K. Lauf, Ph.D., Kristopher T. Kahle, Norma C. Adragna-Lauf, Ph.D.

Apelin Regulation of Potassium Chloride Cotransport (KCC) in Vascular Smooth Muscle Cells (VSMCs): Relation to Cardiovascular Disease (CVD)

Student Presenter(s): Neelima Sharma, Graduate Student in Biomedical Sciences

FACULTY MENTOR: NORMA ADRAGNA-LAUF, PH.D.
DEPARTMENT: PHARMACOLOGY AND TOXICOLOGY

Apelin, a potent inodilator, uses the NO pathway to elicit its anti-atherogenic effect, and the PI3K/Akt and MAPK pathways to induce proliferation and migration of VSMCs. The NO pathway is predominant in healthy blood vessels and contractile VSMCs, whereas, the PI3K/Akt/MAPK pathways are prominent in diseased blood vessels and secretory VSMCs. VSMCs participate in atherosclerotic lesions due to their capacity to migrate and proliferate. Oxidized plasma cholesterol (oxLDL) is a detrimental factor in atheroma formation. It is known that KCC uses the same regulatory pathways (Adragna et al. 2006) as apelin and is implicated in CVD. Here, we tested the hypothesis that apelin through its APJ receptor signaling pathways regulates KCC. Expression and distribution patterns of contractile proteins were studied by Western blot and immunofluorescence. KCC activity was measured by atomic absorption spectrophotometry with Rb as K congener ± inhibitors of the aforementioned signaling pathways and by blocking other K+ transport mechanisms. The APJ receptor and key components of the signaling pathways were verified immunologically. VSMCs' identity was established by appropriate markers. Apelin stimulated KCC activity through the NO pathway by 335 % and by 142 % through the MAPK/PI3K pathways, In contrast, oxLDL inhibited baseline KCC in contractile VSMCs, and this inhibition was restored by apelin. These findings prove the hypothesis that apelin regulates KCC activity through the aforementioned pathways, are relevant to CVD and have potential as therapeutic targets. Supported by WSU Foundation.

Co-Authors/Collaborators: Norma C. Adragna-Lauf, Ph.D. and Peter K. Lauf, Ph.D.

TCDD-induced Activation of the Human Igh hs1,2 Enhancer is Not Altered by Mutation of Transcription Factor Binding Sites Within the Polymorphic Region

Student Presenter(s): Andrew Snyder, Graduate Student
FACULTY MENTOR: COURTNEY SULENTIC, PH.D.
DEPARTMENT: PHARMACOLOGY AND TOXICOLOGY

The environmental contaminant 2,3,7,8-tetrachlorodibenzo-ρ-dioxin (TCDD) is a suppressor of immunoglobulin (Ig) expression in various animal models. This effect appears to be mediated through the aryl hydrocarbon receptor (AhR). When activated by ligand, the AhR binds to dioxin response elements (DRE) leading to altered transcriptional activity. Our previous results identified DRE sites and TCDD-induced binding of the AhR to these sites within a transcriptional regulatory region (3'*Igh*RR) that controls Ig heavy chain expression. The 3'*Igh*RR consists of four enhancer regions (hs3A; hs1,2; hs3B, hs4) and is sensitive to TCDD-induced inhibition, which correlates with TCDD-induced inhibition of Ig expression. In humans, the hs1,2 enhancer (hu-hs1,2) is polymorphic and has been associated with certain autoimmune diseases. We have identified TCDD-induced activation of the hu-hs1,2 enhancer and a decrease in enhancer activity with deletion of the polymorphic region. The objective of the current study was to utilize mutational analysis and luciferase reporter constructs to evaluate the contribution of each transcription factor binding site within the polymorphic region to hu-hs1,2 activity and modulation by TCDD. TCDD induced a similar fold-induction in hu-hs1,2 reporter activity regardless of which transcription factor was mutated; whereas these mutations lead to an increase in basal hs1,2 activity. Evaluation of the binding sites 5' of the polymorphic region demonstrated an increase in hs1,2 activity when the Oct site was mutated and a marked decrease in activity when the AP-1/ETS site was mutated. However, these mutations had little effect on TCDD-induced activation. These results suggest a complex interaction of proteins binding within the hu-hs1,2 enhancer and a consistent increase in hs1,2 activity by TCDD. A better understanding regarding the role of the hu-hs1,2 enhancer and how TCDD modulates its activity may lead to insights into the etiology of autoimmune disorders associated with the hs1,2 polymorphism.

Co-Authors/Collaborators: Sharon Ochs, Brooke Johnson, Courtney Sulentic, Ph.D.

Role of AT1a Receptor in 2K1C Model of Renovascular Hypertension and its Impact on Renal Neprilysin (NEP) Protein Expression

Student Presenter(s): Laale Alawl, Graduate Student in Pharmacology and Toxicology
FACULTY MENTOR: KHALID ELASED, PH.D.
DEPARTMENT: PHARMACOLOGY AND TOXICOLOGY

Activation of the renin angiotensin aldosterone system (RAAS) and the elevated formation of angiotensin (Ang) II contribute to initiation and progression of chronic kidney disease (CKD). Ang II, the major biological active peptide of the RAAS, acts mainly as a vasoconstrictor through binding to the Ang II type 1 receptor (AT1R) which leads to increased blood pressure, fluid retention, and aldosterone secretion. The Neutral Endopeptidase (NEP) forms the vasodilator Ang-(1-7) which opposes Ang II actions. The two-kidney, one clip (2K1C) Goldblatt approach is an experimental model for renovascular hypertension induced through unilateral clamping of the renal artery of one kidney. We tested the hypothesis that hypertension in the 2K1C model is mediated via AT1R. We also investigated the effect of 2K1C on renal NEP protein expression. AT1R wild type (WT) and knockout (KO) mice were used. Blood pressure (BP)

measurements by radiotelemetry revealed a significant increase of 46.1±3.6 mm Hg in 2K1C WT animals compared to control animals ($p<0.001$). Furthermore, BP at baseline and after renal artery clipping was significantly lower in AT1KO mice compared to WT mice (91.5±98.06 mm Hg vs. 104.02±152.1 mm Hg, $p<0.001$). Immunofluorescence demonstrated NEP was localized in the proximal and distal renal tubules. Western blot and immunofluorescence analysis showed NEP was significantly reduced in clipped 2K1C kidneys compared to the contralateral unclipped kidneys or to control mice. Renal pathologies were exacerbated in the 2K1C model as revealed by a significant increase in mesangial expansion and renal fibrosis. Results suggest that renovascular hypertension is mediated via AT1aR and that NEP is downregulated in chronic kidney injury. Taken together, these results indicate that loss of NEP may attenuate renoprotective effects via impaired formation of Ang-(1-7) and suggest an important role of Ang II signaling in hypertensive patients with CKD.

Co-Authors/Collaborators: Nadja Grobe, Ph.D., Sana E. Emberesh, Khalid M. Elased, Ph.D.

Effect of Rosiglitazone on Renal and Urinary Neprilysin (NEP) in db/db Diabetic Mice

Student Presenter(s): Sana Emberesh, Graduate Student in Pharmacology and Toxicology

FACULTY MENTOR: KHALID ELASED, PH.D.

DEPARTMENT: PHARMACOLOGY AND TOXICOLOGY

Neprilysin (NEP, Neutral endopeptidase) also known as CD10, enkephalinase, and CALLA (common acute lymphoblastic leukemia antigen) is a cell surface zinc metalloendopeptidase, involved in metabolism of several biologically active peptides such as Angiotensin (Ang) I which is degraded into Ang-(1-7), a vasodilator counter-regulating the potent vasoconstrictive, fibrotic and inflammatory effects of Ang II action in the heart, kidney and vascular system. The aims of this study is to test the hypothesis that, 1) there is downregulation of renal NEP protein expression in the db/db mouse model of type 2 diabetes compared to control, 2) treatment with the insulin sensitizing agent, rosiglitazone will normalize hyperglycemia, attenuate albuminuria and upregulate renal NEP protein expression, 3) urinary NEP is an index of intra-renal NEP status. Six-week old control and db/db mice groups were fed either normal chow or rosiglitazone diet (20mg/kg/day) for 8 weeks. Metabolic parameters, blood glucose and 24hr urine were collected and measured weekly. Treatment with rosiglitazone significantly decreased blood glucose after one week and normalized hyperglycemia throughout the 8 week duration ($p<0.0001$). Urinary albumin excretion was significantly increased in db/db mice compared to control. After two weeks of chronic treatment with rosiglitazone albuminuria was significantly ameliorated ($p<0.001$). Western blot analysis showed renal and urinary NEP protein expression was significantly downregulated in untreated db/db mice compared to lean control mice and was upregluated in rosiglitazone treated db/db mice. In conclusion, loss of renoprotective effects mediated by NEP in diabetes might contribute to the development of diabetic kidney disease, which could be attenuated with rosiglitazone. Urinary NEP could be used as a potential biomarker for diabetic kidney disease, for monitoring the effectiveness of renoprotective medication and as an index of intra-renal RAS status.

Co-Authors/Collaborators: Laale Alawi, Sridevi Gutta, Nadja Grobe, Ph.D., Khalid M. Elased, Ph.D.

Use of Hair Follicles as a Non-invasive Sampling Technique for Genotyping for ACE2 and AT1R Knockout Mice

Student Presenter(s): Lesan Mattis, Graduate Student

FACULTY MENTOR: KHALID ELASED, PH.D.

DEPARTMENT: PHARMACOLOGY AND TOXICOLOGY

Cardiovascular disease is the leading cause of mortality and morbidity in the United States. The renin angiotensin system (RAS) plays a fundamental role in the patho-physiology of cardiovascular disease. The two main RAS peptides angiotensin (Ang) II and Ang-(1-7) have counter-regulatory roles. While an accumulation of Ang II causes a rise in glomerular pressure and permeability, inflammatory state, fibrogenesis and oxi-dative stress mediated by the Ang II type 1 receptor (AT1R), Ang-(1-7) is thought to oppose the actions of Ang II. Ang-(1-7) is formed from Ang II by angiotensin-converting enzyme 2 (ACE2). The aim of this study is to understand how the interruption of Ang II processing or Ang II signaling affects the cardiovascular system using ACE2 or AT1R knockout (KO) and wildtype (WT) mice. As a first step, an efficient screening technique for genotyping of ACE2 and AT1R mice was established. DNA was isolated from tail clips of 4-10 days old mice using the Qiagen or Chelex method followed by amplification using Polymerase Chain Reaction (PCR). A novel approach to genotype mice older than 10 days was introduced by using DNA extracted from hair follicles. ACE2 geno-typing using tail clips or hair follicles showed PCR products for WT mice at 380 bp, for heterozygous mice at 191 and 380 bp and for KO mice at 191 bp. For AT1R geno-typing, a PCR product was obtained at 483 bp for WT mice and at 520 bp for KO mice. Upon comparison of the Chelex approach with the Qiagen method, we found that the Chelex protocol using hair follicles was superior in terms of speed (20x faster), costs and efficiency without compromising the quality of results. We demonstrated the utility of hair follicles as a sensitive and cost-effective strategy for ACE2 and AT1R genotyping. This approach will aid future cardiovascular research.

Co-Authors/Collaborators: Khalid M. Elased, Ph.D. and Nadja Grobe, Ph.D.

Political Science

Military Research and Developmental Effects on Foreign Policy

Student Presenter(s): James Agee, Undergraduate Student in Political Science
FACULTY MENTOR: LAURA LUEHRMANN, PH.D.
DEPARTMENT: POLITICAL SCIENCE

The purpose of this research project was to provide a basic overview of recent major research and development within China's military, the People's Liberation army (PLA), and the different applications and advantages that said projects provide to the PLA and its branches; the People's Liberation Army Air Force (PLAAF) and the People's Liberation Army Navy (PLAN). The project looked at major developments such as the J-20 and J-31 stealth fighters, the new carrier Liaoning, UAV's, and the new MBT-3000, as well as PLA training and restructuring. Assessing these developments the research looked into the development over time of these technologies and comparisons to, but not restricted to, current United States technologies and their developments. From this analysis the research touched on possible future scenarios or applications of the PLA research and development and their ability to use the technology to project PRC power regionally and internationally.

Unity or Rivalry? The Role of Identity in European Integration

Student Presenter(s): Caitlyn Banis, Graduate Student in International and Comparative Politics
FACULTY MENTOR: LIAM ANDERSON, PH.D.
DEPARTMENT: POLITICAL SCIENCE

The role of nationalism and identity has become increasingly significant in the European Union's (EU) efforts to cultivate a transnational identity and further integrate the region through common EU policies. The importance of identity in promoting Europeanization has increased significantly, as support for further integration will be more likely among those who see themselves as distinctly European. My research question is whether a distinct, European identity has come into being for EU citizens and whether a higher level of European identification corresponds with support for EU policies and further political integration. The role of multiple identities and whether national identification can coexist with European identity will also be explored within my research. I will be testing my hypotheses through statistical analysis of nationalism and European identity using data from the European Commission's Eurobarometer surveys. I will also be analyzing literature and discourse on identity within EU member states to add context and illustrate the role of identity in European integration.

Threat Perceptions and National Power: Explaining China's Rise

Student Presenter(s): Christopher Dias, Graduate Student in International and Comparative Politics
FACULTY MENTOR: LAURA LUEHRMANN, PH.D.
DEPARTMENT: POLITICAL SCIENCE

There is no overlooking China's objective to increase its national power and become an Asian regional power. In the past two decades, China has replaced Japan as the second largest economy, and has become a challenger to the United States' status as a regional hegemon. The purpose of this research is to analyze the key motives behind China's increase in national power. This research employs qualitative analysis of China's strategic resources, conversion capability, and historical memory to assess the CCP's threat perceptions. These three indicators lead to two assumptions: first, citizens challenging CCP political rule is the largest threat to China's leadership. Second, the United States' military presence around

China's periphery is the largest external threat. Threat perceptions, for this research, were separated into distinct categories—internal threat and external threat. I operationalize threat as a situation with an increased probability of becoming dangerous where an opposing state or internal factors has the capability to inflict harm to the state and state leadership. Internal threats include: social unrest, regional or national strikes, military coups or uprisings without civil war, political crises threatening the political system. External threats include: military provocations, border clashes or incidents, military conflict with countries further away (directly or indirectly challenging national interests), and military intervention arising from international obligations within the alliance. I have identified specific areas where China is increasing its military capability to constrain and minimize threats. Moreover, I propose that the CCP has also systematically linked external and internal threat through the construction of historical memory to legitimize its rule. A narrative of humiliation has helped solidify CCP leaders' legitimacy, and the authority to identify threats and stabilize those threats. China's leadership fears internal challenges and amplifies external threat to justify authoritarian control.

The Chinese and African Relationship: Oil Interests, Economic Growth, and the Trifecta

Student Presenter(s): Devin Faggs, Undergraduate Student in Political Science

FACULTY MENTOR: LAURA LUEHRMANN, PH.D.
DEPARTMENT: POLITICAL SCIENCE

With its sights set on improving the country's image as a rising star on the international stage, China has recently taken a special interest in the abundance of resources located in Africa. Because China is the world's second largest oil user, the demand for oil and gas reserves in China has dramatically increased. Africa's oil resources may meet China's increased demand, however, the People's Republic of China (PRC) must be careful not to impose on the infrastructure already established with other countries such as the United States that exist within Africa. Cooperation between China and the United States could improve coordination and reduce duplication of efforts which benefit the African people. China must also address concerns from African countries on the negative effects of China's trade and investment practices. As African resources become increasingly important throughout the global market, moving more African countries to middle-class status, foreign relationships must be evaluated to determine which are most beneficial.

How Does Rivalry Impact Soft Power?: China's Utilization of Soft Power Among Rival States

Student Presenter(s): Martin Kalfas, Graduate Student in International and Comparative Studies

FACULTY MENTOR: LAURA LUEHRMANN, PH.D.
DEPARTMENT: POLITICAL SCIENCE

This presentation displays the results of a review of the literature written on the concepts of rivalry and soft power. The review attempts to identify salient trends in the literature while also investigating its strengths and possible gaps that may exist in the scholarship. Due to the embrace of promoting soft power by the People's Republic of China and its participation in rivalry relationships among many of its East Asian neighbors, the review will include research focused on Chinese rivalries and soft power initiatives. From possible gaps identified in the literature, I will propose that new research must be conducted in order to account for phenomena that the previous literature may have neglected.

While these two concepts have different definitions, the literature written about rivalry and soft power possess numerous similarities. Research conducted on the two concepts both center on debates regarding how the concepts ought to be defined and the specific attributes of each. These similarities represent the vibrant nature of the two literatures which produce numerous new

insights into the two concepts. Furthermore, there is evidence of the studies being combined together, producing research investigating how rivals may utilize soft power as a dimension of their rivalry relationship.
However, this does not account for a gap in the literature where there is little investigation into the effects of a rivalry relationship on a state's willingness to promote soft power among its designated rival. I propose that research must be conducted on the effects of rivalry relationships on the inclination of states to expand soft power among rivals. Considering its enthusiasm regarding soft power, I believe an examination of China's soft power promotion among rivals such as Japan and the Republic of China on Taiwan will provide an excellent opportunity to understand rivalry's effects on soft power.

Regional Organizations: Tools of the Powerful for Peace?

Student Presenter(s): Kraig Reiber, Graduate Student in International and Comparative Studies
FACULTY MENTOR: DECEMBER GREEN, PH.D.
DEPARTMENT: POLITICAL SCIENCE

Dating back to the late 1700s, political scientists have been arguing international organizations are important because they help states cooperate and promote peace. However, the failure of the League of Nations and the start of World War II told a different story. States needed to look out for their own interests and international organizations would only be used by powerful states to control weaker ones. International organizations did not seem to matter. Despite this, states created the United Nations, European Union, and joined hundreds of international organizations. The European Union especially has been successful in promoting peace. This led to my research question, what factors influence the success of international organizations' promotion of peace? Previous research has focused on using large sample sizes looking for correlation between characteristics of international organizations and conflict, with mixed results. They examined the regime type of members, structure and leadership of the organization, subjects of cooperation, and the number of international organizations in the international system. This paper will focus on testing these previous theories through a comparative case study of regional organizations and intervention in civil conflicts. A comparative case study can help identify if there are causal links between these variables of international organizations and conflict, not just correlation. Focusing on intervention in civil conflicts establishes a critical case test for international organizations. I plan to compare cases within the Organization of American States and the African Union to focus on the variables of democracy and hierarchy.

The Rise and Decline of International Adoption from China

Student Presenter(s): Paula Sloas, Undergraduate Student in International Studies
FACULTY MENTOR: LAURA LUEHRMANN, PH.D.
DEPARTMENT: POLITICAL SCIENCE

The purpose of this research is to examine the rise and decline of international adoption from China and the possible reasons behind them. International adoptions spiked in 2004, with an estimated 45,000 overseas adoptions. In 2011, that number declined to 23,000. The reasons for increased abandoned infants in China are complex and include a combination of political, cultural, and social structures. Abandonment increased considerably in the late 1980s and early 1990s. This coincides with the implementation of the one-child policy in 1979. In the 80s, only 2 methods of contraception were available; the intrauterine device and sterilization. Now short-term contraception like the pill and condoms are available but come with a higher risk of pregnancy. Therefore, the abortion rates have increased due to accidental pregnancies. The regulations of adopting a child from China have become stricter over the years. There are certain age, health, and

financial requirements. The biggest change to the regulations is the addition of the Body Mass Index, which cannot exceed 40. Now, couples in China are allowed to have two children if one of the parents is an only child. Many aspects led to the rise of international adoption from China. The one-child policy did not allow more than one child for each family. Families had to make changes. Contraception changes with weaker forms of controlling birth led to more accidental pregnancies. These pregnancies either resulted in abortions or children who needed new homes.

How has reform affected Kerala's caste system?

Student Presenter(s): Brian Storch, Graduate Student in International and Comparative Studies

FACULTY MENTOR: PRAMOD KANTHA, PH.D.
DEPARTMENT: POLITICAL SCIENCE

The Indian state of Kerala has the highest literacy, highest life expectancy and best Human Development Index score of India. Political scientists, historians and anthropologists evaluate the "Kerala Model", or Kerala's system of welfare and education programs, in order to analyse a possible model of success for the rest of India and postcolonial world. Many scholars point to the high religious tolerance, the socialist system and anti-caste reforms implemented by the Indian Communist Party, led Left Democratic Front (LDF), as the source of Kerala's success. However, critics recognize that Kerala still has a high level of caste violence and discrimination within state and society. Critics also claim that the current demographics are a result of reforms made prior to the rise of the LDF in the 1957 elections. The purpose of this study is to evaluate the Keralite caste system from 1847 to 2004 in order to test both sides of the argument and determine exactly how reforms have changed it. I will evaluate primary and secondary historical sources in order to compile models of the Keralite caste system at points where reform was implemented. The major periods I will analyze are 1847, 1928, 1957, 1969, 1982, 1987 and 2004, points at which there were major reforms or major electoral changes that resulted from reforms. I will conduct a comparative historical analysis of the data in order to find a process in which government reforms and elections effect changes between the models. I will then conclude my own assessment of current arguments of the Kerala model and caste politics based on my findings.

Sino-U.S. Relations: Equilibrium in the Asia-Pacific

Student Presenter(s): Garrett Teets, Undergraduate Student in International Studies

FACULTY MENTOR: LAURA LUEHRMANN, PH.D.
DEPARTMENT: POLITICAL SCIENCE

The geostrategic dynamic of the Asia-Pacific region is largely dominated by the United States (U.S.) and the Peoples Republic of China (PRC). It is this bilateral relationship that governs the strategic thought and diplomatic initiatives of the Pacific States. The conventional dominance of the U.S.' military is the greatest factor driving the strategic thought of the PRC. The voting record of the PRC within the United Nations Security Council (UNSC), largely consisting of abstentions, can be tied directly to the geo-strategic realities of the Asia-Pacific. The Peoples Liberation Army (PLA) will continue to enjoy budgetary allowances far in excess of what the PRC's neighbors are capable of or willing to muster, and modernization at break neck speeds, so long as the U.S. remains committed to its ubiquitous presence in the Asia-Pacific. I conjecture that the PRC's conduct on the world stage thus far is intrinsically linked with the Sino-U.S. dynamic in the region. When the PLA is capable of deterring or defeating United States Pacific Command (USPACOM) a far more assertive PRC can and should be anticipated both regionally and in transnational forums like the UNSC.

Kutembea Na Askari: Reflections of a Wright State's Student-Led Civil Rights Pilgrimage

Student Presenter(s): Michael Tyler, Graduate Student in Humanities
FACULTY MENTOR: TRACY SNIPE, PH.D.
DEPARTMENT: POLITICAL SCIENCE

African-Americans, who have come of age after the close of the civil rights era, have many misconceptions about the Civil Rights Movement that hinder their quest for cultural identity. These misconceptions emerge from an incomplete and conflicting understanding of the history and accomplishments of the Movement. This session will serve as a reflection on lessons obtained from the pilgrimage and how student-led pilgrimages can increase cultural awareness within the Wright State community.

Co-Authors/Collaborators: Andrianna Milton

Recognizing Historical Memory and its Implications toward Nationalism; Case Studies in East Asia

Student Presenter(s): Hannah Collins, Graduate Student in International and Comparative Politics
FACULTY MENTOR: LAURA LUEHRMANN, PH.D.
DEPARTMENT: POLITICAL SCIENCE

The purpose of this research is to understand the relationship between historical memory and nationalism within the East Asian region. This research draws upon Zheng Wang's book Never Forget National Humiliation as he draws connections to how and why certain traumatic events are remembered in China, and how the Chinese Communist Party uses these memories to bolster nationalism in an effort to gain a new form of legitimacy. Today, references to past traumatic events have been cited for current terse relations between states, specifically between the states of South Korea and Japan. Due to their shared tumultuous history it is clear that there is active historical memory in this region towards events that have taken place more than a hundred years ago. Points of historic contention has been stated as Japanese military utility of sexual slavery, commonly termed "Comfort Women" and the Japanese colonization of the Korean peninsula through oppressive rule. Given Wang's example, does historical memory increase nationalism within other states such as South Korea and Japan? I will conduct two case studies on these states, examining indicators such as the presence of historical memory and nationalism through history text books, museums and monuments, publications such as newspapers and popular books and state rhetoric and speeches made concerning targeted historical events. Understanding the relationship between historical memory and nationalism within states can begin the process of placing importance on the ways in which events are remembered, and adequate ways in which to address past events so as not to create discord and tension between states in the future.

Negotiating Cooperative Management and Use of Transboundary Drainage Basins: A Comparative Case Study of the Asi-Orontes, Jordan, and Tigris-Euphrates Drainage Basins

Student Presenter(s): Kuyer Fazekas, Graduate Student in International and Comparative Studies
FACULTY MENTOR: VAUGHN SHANNON, PH.D.
DEPARTMENT: POLITICAL SCIENCE

Water security has become one of the most controversial and complex issues in the field of international security and resource scarcity issues today. Growing physical and political pressures in the allocation of freshwater resources in the Middle East will continue to increase unless systematic measures are undertaken to generate more value from cooperation in the equitable allocation of freshwater resources between riparian states (those located on the bank of a natural watercourse). I engage in a comparative case study of resource diplomacy in the Asi-Orontes, Jordan, and Tigris-Euphrates drainage basins to explain

the reasons for variation in cooperation in these three cases. In each case I examine past and present conflicts and agreements over freshwater resources by utilizing the International Water Events Database that contains data from 1948 to 2008. Additionally, I utilize the Basins At Risk Scale (Water Event Intensity Scale) to quantitatively analyze the intensity of specific water events within these two drainage basins.

The Power of International Influence on Domestic Policy: The Case of China

Student Presenter(s): Sarah Matos, Undergraduate Student in International Studies
FACULTY MENTOR: LAURA LUEHRMANN, PH.D.
DEPARTMENT: POLITICAL SCIENCE

The purpose of this research is to identify the impact that international participation has had on China's domestic policies, specifically its policies toward women and gender equality. Historically, women in China experienced oppression and domestic isolation. During the rise of the Chinese Communist Party (CCP) in the 1920s, women were called to participate in the work force, which brought them outside the home and closer to equality. However, this move was more a matter of expediency than actual change in attitude towards women. Following the Cultural Revolution, China opened its doors to the West in 1972 to permit economic expansion. An unintended consequence of this action was that the country's internal affairs and policies were exposed to western criticism, particularly in regard to the country's treatment of women and girls.

A CCP concern is how to make crucial policy changes without appearing to have conceded to Western pressure. China's history is a complicated mixture of centuries-old tradition, unstable political structures, and a wounded past. The Party has taken steps to address gender inequality. The creation of the All China Women's Federation was progressive, but the organization has had limited influence changing the treatment of women. Another development was appointing females into political office. Another undertaking was the hosting of the 1995 Fourth World Women's Conference in Beijing. This conference was one of the largest United Nation's conferences ever held. Furthermore, the recent relaxation of the one-child policy reflects progress. Although we observe social progress for women and girls in China, issues still exist that need to be addressed. As China increases its presence on the world stage, its record on gender equality is likely to be even more closely scrutinized, perhaps complicating the task before the CCP in this regard.

Tremors and Earthquakes: An Examination of the Unites States' Compliance with Rule of Law as it relates to Domestic and International Terrorism

Student Presenter(s): Jonathan Maze, Graduate Student in International and Comparative Studies
FACULTY MENTOR: VAUGHN SHANNON, PH.D.
DEPARTMENT: POLITICAL SCIENCE

Assessing Rule-of-law compliance in U.S. counter-terrorism is a complex task. This paper will examine the Clinton, Bush, and Obama administrations' record of compliance with international and domestic legislation when enacting counter-terrorism strategies, before and after September 11, 2001. I engage in a comparative case study to ascertain the effects of political psychology, political ideology, and location of terrorist attacks, on compliance behavior and the utilization of judicial or extra-judicial frameworks. I also test to see if the United States prosecutes domestic terrorists differently from foreign terrorists.

Human Rights in Chechnya and Xinjiang

Student Presenter(s): Hanna Tarbert, Graduate Student in International and Comparative Studies
FACULTY MENTOR: LUARA LUEHRMANN, PH.D.
DEPARTMENT: POLITICAL SCIENCE
This project is a comparative analysis of the human rights situation in Chechnya, a disputed territory in Russia, and Xinjiang, a disputed territory in China. The Chinese government has embarked on a campaign of 'Sinicization' in Xinjiang in order to legitmize Xinjiang as being part of China by creating a unified sense of Chinese identity. Russia has pursued 'Chechenization' in order to maintain control over Chechnya by creating a specific and distinct Chechen identity. Russia and China use different strategies to shape minority national identities to maintain control of disputed territory but, have violated the human rights of these minorities in similar ways. I assess three specific areas of human rights violations: forced disappearances, religious freedom and the right to self-determination and forecast the future of human rights in each region.

Psychology

Student Support Seeking Strategies and Burnout

Student Presenter(s): Jason Farkas, Undergraduate Student in Psychology
FACULTY MENTOR: GARY BURNS, PH.D.
DEPARTMENT: PSYCHOLOGY

Academic burnout is a concern for educators and students alike. Often considered the result of situational variables, burnout has only recently been correlated with stable individual personality traits. Considerable research has been undertaken on the subject of trait optimism and fear of failure as a predictor for academic outcomes (GPA, test scores, etc.). Conspicuous in its absence is literature concerning the relationship between these variables and academic burnout. Further, it is in the interest of the educational community to determine what individual differences may play a part in a student's choosing to seek support when suffering burnout. Every day, students abandon their education without seeking support from professors or peers. Implementation of effective burnout interventions to decrease student attrition and increase student well-being depends on our understanding of who is most at risk for burnout and offering support when they need it most. This also has implications for school diversity, as African-American students are more likely to leave school without seeking support. The current study will examine combinations of stable personality traits and support seeking strategies in relation to measures of student burnout. Of particular interest is the student's dispositional approach to college (academic optimism vs. fear of failure) and likelihood of support-seeking behaviors. Survey measures will be developed to administer to current students through the Qualtrics system. As this research is still in its infancy, the Celebration of Research event will be an excellent way to interact with students and educators to determine further measures that should be included.

Co-Author/Collaborator: Gary Burns, Ph.D., David Periard

Social Buffering and its Effects on Subsequent Learning

Student Presenter(s): Darci Gallimore, Undergraduate Student in Psychology
FACULTY MENTOR: DRAGANA CLAFLIN, PH.D.
DEPARTMENT: PSYCHOLOGY

This pilot study explored the effects of early-life stress on subsequent learning in preweanling rats. The level of stress an animal experiences can have different effects on learning: too little or too much potentially impairs learning, while intermediate levels help facilitate learning. Social buffering is the modulating effect a conspecific animal, such as a mother, has on the stress response of another animal (Kiyokawa, 2007). We manipulated stress exposure on one occasion and then tested learning on a subsequent occasion using classical eyeblink conditioning (EBC). During EBC subjects are exposed to repeated trails in which a tone was followed by a mild shock that produced an eyeblink response. Typically, when learning occurs, the animal will blink after the tone in preparation for the shock. In the present study, there were three conditions for pre-exposure: context only, shock only, and EBC training. Animals participated individually in three 50 minute sessions presented four hours apart on postnatal day 17 (pre-weaning). Within each condition, some animals experienced maternal separation for 90 minutes directly after each pre-exposure session (no social buffering group), while the others were returned to the home cage with mother (social buffering group). Preliminary data show that when animals were trained on EBC one week later, the no social buffering appeared to slow down acquisition of EBC compared to the social buffering group.

Although the present data are inconclusive due to insufficient statistical power, the potential implications of this study are important for our understanding of the development of various stress-related psychiatric illnesses, including depression and PTSD. The value of social partners in reducing stress may be critical for the healthy development of cognitive abilities.
Supported by: NIH/NIGMS, R25GM090122, IMSD BioSTAR and the Department of Psychology, Wright State University.
Co-Authors/Collaborators: Dragana Claflin, Ph.D., Ashley Carroll, and Feras Deek

Predicting Workplace Interactions: Counterproductive Work Behaviors, Interpersonal Relationships and Select Big Five Traits

Student Presenter(s): Sarah McLaughlin, Undergraduate Student in Psychology
FACULTY MENTOR: GARY BURNS, PH.D.
DEPARTMENT: PSYCHOLOGY

Research examined Counterproductive Work Behaviors (CWBs), workplace Interpersonal Relationships (IRPs), and three of the Big Five traits. CWBs are important because they cost companies money in lost productivity and property. CWBs are active decisions; therefore, we can examine which personality traits influence these behaviors. We examined agreeableness, conscientiousness, and emotional stability. We studied interpersonal relationships (IPRs) because research has not shown how they influence counterproductive tendencies. Our final sample had 132 participants (54% male), with an average age of 32 years (SD = 10.63). We measured CWBs using Spector's 32-short item test which measured abuse, production deviance, sabotage, theft, and withdrawal (Spector, 2006). Personality traits were measured using 10-item scales from the International Personality Item Pool (Goldberg, 2006). We adapted Pierce's (1998) 7-item romantic relationship scale to measure IPRs by changing "sexual relations" to "interpersonal relationships". Correlations for CWBs with IPRs ($r = -.253$, $p > .05$), agreeableness ($r = -.454$, $p < .000$), and conscientiousness ($r = -.390$, $p < .000$) were significant. A total of 29.2% of the variance for CWBs was predicted by personality traits ($F(3,128) = 17.591$, $p < .05$) in a regression analysis. Looking at the interaction between personality and IPRs, an additional 8.7% of the variance in CWBs was explained by IPRs and conscientiousness ($F(2, 129) = 12.763$, $p < .05$). The interaction of IPRs with agreeableness explained an additional 2.8% ($F(2,129) = 18.598$, $p < .05$) of the variance. Both suggest employees with high levels of either trait are less likely to engage in CWBs when they view IPRs favorably. Overall, employees who engage in, or think about engaging in, IPRs are statistically less likely to commit CWBs than employees who do not engage in, or think about engaging in, IPRs. Companies should evaluate employee policies and promote friendships to decrease counterproductive behaviors.
Co-Authors/Collaborators: Bryan Faber & Aaron Williams

Internet Abuse and Impairment

Student Presenter(s): Mohsin Sultan, Undergraduate Student in Psychology
FACULTY MENTOR: GARY BURNS, PH.D.
DEPARTMENT: PSYCHOLOGY

The present research investigated Internet usage and its effect on loneliness, the general health of an individual, emotional stability, extraversion, and conscientiousness. Undergraduate Wright State University students (n=125) were given an online self-report questionnaire to assess these variables, along with items assessing how frequent, the duration, and for which reasons an individual chooses to use the internet. Compulsive internet use was measured through a 14-item Compulsive Internet Use scale which measured the frequency of internet usage along with its effects on an individual's relationship with family, work, and daily tasks functioning (Meerkerk, Van den Eijnden, Vermulst, &Garretsen, 2009). An 8-tem Internet Addiction questionnaire which is used to screen if an individual may be diagnosed as addicted to the internet, (Young, 1996). Loneliness was measured by the 10-item UCLA Loneliness Assesment which measured the overall loneliness of an individual (UCLA Loneliness Scale, Ferguson, Peplau Russell, 1978) and the general health of an individual was measured by the 12-item General Health Questionnaire which searches for distress in an individual and the inability to carry out normal functions (Goldberg, Williams, 1988). Extraversion, Emotional Stability, and Conscientiousness were measured using the International Personality Item Pool where 10-items were used for each personality trait to measure that level of personality in an individual (Goldberg, 1999). Internet Usage was significantly and positively related with loneliness of an individual($r=.26, p<.05$). There were also significant and negative relationships found between internet usage and extraversion($r=-.275, p<.05$), internet usage and conscientiousness($r=-.311, p<.05$), as well as internet usage emotional stability($r=.185, p<.05$). Individuals, who used the internet more often, had a higher level of loneliness, which supports previous research. Those individuals who were higher in extraversion, conscientiousness, and emotional stability had lower usage of the internet. There have been recent concerns of the growth of internet use, just like any other addiction, the internet can cause impairments to an individual, as the popularity of the internet continues it has the potential to affect anyone who may use the internet. This study expands our knowledge of the role conscientious, extraversion, and emotional stability play in the internet usage of an individual along with the effect of loneliness higher internet usage brings about.

Co-Author/Collaborator: Gary Burns, Ph.D.

Public Health

The Socioeconomic Status of Adolescent Mothers and its Relationship to Prenatal Care and Fetal Health in Franklin County, Ohio

Student Presenter(s): Christen Johnson, Medical Student and Graduate Student in Public Health

FACULTY MENTOR: SARA PATON, PH.D.

DEPARTMENT: COMMUNITY HEALTH

The Socioeconomic Status of Adolescent Mothers and its Relationship to Prenatal Care and Fetal Health in Franklin County, Ohio observes the influence of socioeconomic status of adolescent mothers during their pregnancy as described by WIC status and fathers' educational attainment on their use of prenatal care and the presence of adverse fetal health outcomes. A descriptive analysis of retrospective data was designed to observe the influence of the socioeconomic status of 1512 adolescent mothers between the ages of 13 and 19 years old on the quantity of prenatal care visits and adverse health outcomes observed at birth. All data was secured from birth records from Franklin County, Ohio for the 2010 year. Pivot tables were used to sort and provide counts for each data category. Data analysis was performed using percentages, relative risk ratios and point prevalence values. The adequacy of prenatal visits was assessed by the adequacy standards, 80% or about 9 prenatal visits, recommend by the American College of Obstetrics and Gynecology. Adverse health outcomes were assessed by the infant's admission into the NICU. The mean age for the mothers was 17.85 years. The point prevalence for receiving WIC assistance in mothers with fathers who had a high school diploma or less was calculated to be 75%, almost equal to that of WIC status alone. WIC assistance was found to be a protective factor for both attending the recommended number of prenatal visits and for infants not being admitted to the NICU. Inadequate prenatal care was seen to increase the risk of NICU admission by 205%. This study showed success in the assistance programs ability to foster better health outcomes for infants. Study will be continued to confirm results across populations and to better assess needs in order to suggest and implement successful programing.

Social Work

Changes to the Social Work Curriculum Since 2008

Student Presenter(s): Ashley Hartlaub, Undergraduate Student in Psychology
FACULTY MENTOR: SARAH TWILL, PH.D.
DEPARTMENT: SOCIAL WORK

Over the years since the social work profession has existed, the Council of Social Work Education has issued a list of accreditation standards for social work programs. The latest social work accreditation standard revision in 2008 requires that all social work students master ten core social work competencies and 41 practice behaviors before graduating. As the new standards are being further developed and defined, social work programs are exploring and experimenting with methods on how to best prepare students so they can master, integrate, and apply the ten core social work competencies and 41 practice behaviors to real-life situations as future social workers. In addition, programs are exploring how to create the best learning environment for students. Social work and other similar disciplines help their students master competencies by requiring them to undergo more training and practice. This presentation will highlight the three themes that emerged from the comprehensive literature review. Ninety-eight articles were read, and thematically coded for themes. Three themes were identified: child welfare training programs, evidence based practice, and assessment of student learning. Implications for social work education will be discussed.

Teacher Education

Responding to the NGSS: Local Elementary Teachers' Perceptions of Teaching Science

Student Presenter(s): Erica Riggs, Undergraduate Student in Early Childhood Education
FACULTY MENTOR: MICHELLE FLEMING, PH.D.
DEPARTMENT: TEACHER EDUCATION

The Next Generation Science Standards (NGSS) were introduced as a way to unify the science teaching standards across the United States. The NGSS has brought inquiry level and hands-on methods to the forefront of science teaching. Ohio, however, has not yet adopted the NGSS. This study was designed to look at elementary school teachers' current methods and perceptions of teaching science and how they align with the new Next Generation Science Standards.

Urban Affairs

Corporate Sponsorship at the Local Government Level

Student Presenter(s): Louis Agresta, Graduate Student in Public Administration and David Burns, Graduate Student in Public Administration

FACULTY MENTOR: MYRON LEVINE, PH.D.
DEPARTMENT: URBAN AFFAIRS

Would a corporate sponsorship policy work in Centerville, Ohio? This is a question that has become more important due to decreases in state funding. Corporate sponsorship policies have been adopted by communities throughout the United States as a way to increase revenue without raising taxes. These policies provide a framework for administrators to follow when soliciting advertising and sponsorship on public assets. To answer the research question, a multi-faceted research approach was developed to identify the characteristics and procedures that make a corporate sponsorship policy successful. An exploratory internet search was used to identify the themes that are present throughout established, well-known policies. The corporate sponsorship policies of similar (in terms of demographics and location) communities were also analyzed. Finally, a survey was administered to gauge the sensitivity of the public to the idea of a corporate sponsorship policy. This multi-faceted approach helps to understand the necessary characteristics that should be in place for a corporate sponsorship policy to be successful in Centerville, Ohio.

Co-Author/Collaborator: David Burns

Radio Waves

Student Presenter(s): Will Davis, Graduate Student in Master of Humanities Program

FACULTY MENTOR: MARJORIE MCLELLAN, PH.D.
DEPARTMENT: URBAN AFFAIRS

For the capstone project completing my Master of Humanities degree, I partnered with Kettering Fairmont High School's Interactive Media Program, Victoria Theatre Association, and NPR station WYSO for a service-learning project called Radio Waves. Radio Waves uses the Broadway tour of Memphis The Musical as an example of radio as an agent of social change. My project traces the rise of "race music" on American radio stations in the 1950s, and its influence on rock and roll, rhythm and blues, and, ultimately, the Civil Rights Movement in Dayton, Ohio. Radio Waves researches and records this particularly rich period of radio history by combining the talents and expertise of artists, musicians, disc jockeys, historians, and local high school students. I acted as instructor and producer, and team-lead fourteen high school students through the processes of creating a radio feature story, including researching, interviewing, advanced audio editing, and digital storytelling. Their final deliverables consists of four radio feature stories, while I created two archival representations of my capstone project, one audio, and one literary. Radio Waves utilizes service-learning as a pedagogical tool to help me comprehend the dense material of my individualized program of study, and incorporate it into my professional life. With Radio Waves, I aspire to become a more accomplished and credentialed instructor, independent radio producer, and digital storyteller.