COS JAM 2017

FRIDAY
MAY 5th
1-5 PM
JORDAN HALL

COLLEGE OF SCIENCE JOINT ANNUAL MEETING

ABSTRACT BOOKLET

The 11th College of Science Joint Annual Meeting (COS-JAM) is part of the 10th Undergraduate Scholars Conference. The intent of COS-JAM is to highlight the achievements of undergraduate students conducting scientific research.

COLLEGE OF SCIENCE - JOINT ANNUAL MEETING

Friday May 5, 2017
Jordan Hall, University of Notre Dame

Schedule and Abstracts

Table of Contents

Schedule - Biological Sciences

Oral Presentations I — Jordan Room 105
1:00 - 2:30 p.m.

Moderator: Dominic Chaloner

1:00 John Huber - Quantitative, model-based estimates of variability in the generation and serial intervals of *Plasmodium falciparum* malaria
1:15 Ryan Middleton - The Effects of the Affordable Care Act on Breast Cancer Survival Rates
1:30 William Morgenlander - Immunomodulatory Role of PYGO2 in Prostate Cancer
1:45 Abigail Radomsky - Improving Comprehensive Emergency Obstetric and Neonatal Care (CEmONC) Practices through Retrospective Analysis of Intrapartum Stillbirth Data at the Fort Portal Regional Referral Hospital, Southwesten Uganda
2:00 Abigail Tirrell - Interactions and competitive growth within mixed infections of *Plasmodium falciparum*
2:15 Matthew Weyenberg - The Help Never Reaches Us: A Case Study of Uganda's Foremost Sickle Cell Clinic

Poster Presentations — Jordan Galleria
2:30 – 3:30 p.m.

Carolyn Ahlers - Transcriptional Regulation of Epithelial Membrane Protein 2 After APC Loss
Louisa Antonelli - Calcium Signaling in *Drosophila melanogaster* Ovaries
Anne Arnason - APC regulation of tumor initiating cells in breast cancer
Cayla Bales - Adiposity and Microbiome Diversity in Mice Influenced by Gastrokine 1
Bradley Bowles - Engineering New *In Vitro* Angiogenesis Models
Elise Brady - Early Diagnosis of Osteonecrosis of the Jaw in Response to Bisphosphonate Therapy
Margaret Brecker - Role of Chaperone Protein, ERp29, in Insulin Trafficking and Maturation
Justin Brill - Make no bones without it: Characterization of region-specific behaviors in non-sutural cranial osteoblasts using bone morphogenetic proteins
Mary Brinkman - Loss of MTSS1 results in increased metastatic potential in pancreatic cancer
Erin Carmody - Function and Stability of Gastrokine 1
Jacklyn Cooney - Investigating the species-specific growth responses of Midwestern Oaks to drought conditions.
Patrick Cunniff - Antimicrobial Resistance in Red Oak Acorns
Kathleen Davin - Chemosensation in a Pest Fly, *Drosophila suzukii*
Gabrielle Davis - APC Loss Promotes Early Tumorigenic Phenotypes in MCF10A Mammary Epithelial Cells
Samuel Eallonardo - Effect of Lipid Disruptions on Translational Stop Codon Readthrough in *Mycobacterium marinum*
Kenneth Elkin - Effect of Metabolic Stress on Chlorfenapyr Efficacy using a Novel Flight-Stress Apparatus
Alexander Ellyin - Research of Novel Insecticides
Ryan Engert - Using Transgenic *Aedes aegypti* Mosquitoes to Generate Aaop1 Visual Mutants by CRISPR/Cas9 Mutagenesis

Sarah Fracci - Tumor-induced stromal STAT1 deregulates the mammary tissue homeostasis and accelerates breast cancer development
Kaitlin Frei - Investigation of Neuropeptide F as a Novel Insecticide Target
Anne Gandolfi - Fluorescent Exosome Engineering and Imaging
Claire Goodfellow - Effects of Diet and Seasonality on Parasite Burden in Yellow Baboons of the Amboseli Ecosystem
Nicole Gorman - Exploring the influence of benthic substrate on biofilm growth in experimental streams at ND-LEEF
Nicole Handa - The transcription factor *mecom* acts upstream of the *tbx2a/b* T-box factors to specify distal nephron patterning in the zebrafish pronephros
Abigail Herman - Seasonal Dynamics of Host Parasite Load in Yellow Baboons
Nathan Hermann - Interactive Consumption of Salmon and Non-Salmon Resources by Resident Fishes during Great Lakes Pacific Salmon (*Oncorhynchus* spp.) Spawning Events
Simian Huang - Fossil and Literature Analysis on the Cause of K-T Extinction
Russell Hutson - Acamprosate Rescues Neuronal Defects in the Drosophila Model of Fragile X Syndrome
Katherine Inskeep - From Host Race to Species: Parallel Genome-wide Divergence Mirrors Ecological Differences
Lan Jiang - Real-time investigation of the influence of shear pressure and compression on mitochondria in single disseminated tumor cells during mechanical arrest under PTEN regulation
Joohye Kim - Parasite Burden on Wild Amboseli Baboon Survival
Joseph Krivda - Role of Leishmania protein phosphatase 5 in stress response and pathobiology
Norbert Kuc - Asbestos related pleural disease in insulator workers
William Langbo - Genetic Diversity and Structure of Bur Oak (*Quercus macrocarpa*) Across Its Range
Emily Leyden - Validation of APC-knockdown gene expression profiles
Zoe Loh - GPCR Targeted Insecticide Design for Control of Vector Mosquitoes Transmitting Dengue and Zika
Lea Lovin - Total Mercury Concentrations and Isotopic Niche Overlap in Lake Michigan Prey Fish
Maria Mosley - Investigating the Relationship Between Hemispheric Brain Lateralization and Implicit Learning Performance
Gabrielle Mungcal - Targeting the HSP70 family to overcome chemoresistance in Pancreatic Ductal Adenocarcinoma (PDAC)
Alina Nguyen - Optimizing IHC staining of leptin in *Hyla cinerea* testes
Anthony Nguyen - Genomic Profiling of Light-regulated Genes in the Malaria Mosquito *Anopheles gambiae*
Aileen O'Hayer - Detecting Indels to Obtain Aaop1 and Aaop3 Mutant Lines of Aedes aegypti
Treasa O'Tighearnaigh - Role of mitochondrial transfer in breast cancer adaptation to the brain microenvironment
Angela Pantell - Plant-Pollinator Networks Change with Time in the Burnham Wildlife Corridor
Gabriela Portmann - Deja Food: Diet and Mandibular Biomechanics in Carnivorous and Folivorous Mammals
Samuel Rudisill - The Role of Iron in Neuronal Development
Maria Sasso - Daily Journaling and Depressive Symptoms: Writing in Third Person Leads to Increases in Depressive Symptoms Compared to First-Person Writing, Particularly for Cognitively Vulnerable Individuals
Ryan Seay - Creation of Knockout Arrestin 1 and 2 mosquitoes to understand the importance of light mediated rhodopsin movement in *Aedes Aegypti*

Kara Shannon - The Role of Gastrokine-1 in Susceptibility to Colitis
Maria VanBerkum - Analysis of PTEN in a *Drosophila* Photoreceptor Model of Axonal Regeneration
Joseph Vanderwall - Determining importance of in-lake CO2 production for the carbon budgets of north temperate lakes
Christina Wells - Group Living and Parasitism in Amboseli Baboons
Kevin Wilkins - Characterization of microglial recruitment, activation, and activity in the regenerating zebrafish retina
Philip Wilson - A network rewiring-based approach to differential gene coexpression in *Plasmodium falciparum* identifies components of artemisinin resistance
Claire Wolford - Investigating the role of gastrokine-1 as a link between gut microbiome, host metabolism, and obesity
Robert Wozniak - Investigating Odorant-Baited Traps and Miltefosine for Control and Treatment of Chagas Disease in Belize, Central America
Yutong Yao - Statistical Analysis of Death Records Provides Insights about Childhood Disease Epidemics in 18th Century New England
Xiaoyu Yu - Molecular species identification of mosquito samples from Democratic Republic of Congo

Oral Presentations II — Jordan Room 105
3:30 – 5:00 p.m.

Moderator: Dominic Chaloner

3:30 Dominic Acri - Light manipulation of mosquito behavior: Acute and sustained photic suppression of biting activity in the *Anopheles gambiae* malaria mosquito
3:45 Elizabeth Berg - Comparing heterogeneity in floodplain soils of restored two-stage versus unmaintained agricultural streams
4:00 Sarah Brown - The Dynamic Nature of Representations in Verbal Working memory
4:15 Sean Cullen - The Role of Context Dependency in Mercury Contamination of Pacific Salmon in the Laurentian Great Lakes
4:30 Jugyeong Lee - Effect of a Topical Repellent on Dengue Vector Behaviors

Schedule – Chemistry and Biochemistry

Oral Presentations I — Jordan Room 101
1:00 – 2:30 p.m.

Moderator: Dee Anne Goodenough-Lashua

1:00 Melissa Budicini - Investigating Phospholipid Binding Residues in the C terminus of Ebola Virus Matrix Protein, VP40
1:15 Hannah Dakin - The Role of SUMOylation During Cardiac Development in *Xenopus laevis*
1:30 Kristina Hollkamp - The Role of the Fibrinolytic System in Hypertensive Renal Injury
1:45 Matthew O'Neill - Decarboxylative Cross Couplings as Versatile Synthetic Tools
2:00 Harisa Spahic - Feasibility of Computer Cognitive Training in Adults: Roles of sleep and psychological distress. Pilot Investigation on the Effects of Computerized Cognitive Training on Healthy Individuals and Implications for Application in a Clinical Population.

Poster Presentations — Jordan Galleria
2:30 – 3:30 p.m.

Cecelia Allison - Benchmarking Empirical Force Fields for Ionic Liquids
Michael Anderson - T Cell Receptor Binding Orientation Effect On Downstream Signaling After Peptide Recognition
Sarah Catherine Baker - Stronger Together: The role of cysteine residues in Ebola viral matrix protein VP40
Aviyah Barstis - Creating a Paper Analytical Device to Detect Low Quality Azithromycin-500 Tablets from Nepal
Leigh Campbell - Effects of Lysophosphatidic Acid on Murine Peritoneal Tissue and Ovarian Cancer Cell Peritoneal Adhesion
Lauren Davancaze - Structural Characterization of TIL 1383i to Reengineer Specificity and Affinity
Heather DiLallo - Developing a PAD to Screen for Low-Quality Albendazole
Matthew Goblirsch - miR-543 in Myelofibrosis
Sarah Graney - Investigating the Dynamic Loops of OXA-24/40 using ^{19}F NMR Spectroscopy
Anne Grisoli - Intraperitoneal tumor selection identifies potential mediators of ovarian cancer metastasis
Meghan Grojean - Foretinib, a c-Met / VEGFR inhibitor, augments chemotherapy response in preclinical models of gastric cancer
Alec Helmke - An Examination of the Efficacy of Iodoplatinate towards the Detection of Various Types of Pharmaceutical Products and Recommendations for the Reagents Use in Paper Analytical Devices
Charley Jang - Cryopreserved Mammary Tissue from Transgenic Mouse Models of Breast Cancer Supports Organoid Branching and Cell Dissemination
Elisabeth Kerns - Halide Exchange in Perovskites For Solar Cells
Andrew Latham - Further Applications of Dielectric Constants in Water
Eric Lee - Quantification of plasminogen activation system proteins PLAU, SERPINE2, and SPINT2 in aggressive OVCAR5 and OVCAR8 cell line derivatives
Rachel Lombard - Compression-Induced Cadherin Shifts in Ovarian Cancer Multicellular Aggregates

Arwa Mohammad - Effectiveness of Therapeutic Staurosporine on Inhibition of Budding and Replication of Lipid-Enveloped Viruses

Hannah Naguib - Synthesis of Hyperbranched Polymers with Post-Functionalization Specificity

Matthew Onders - A Mechanistic Investigation of Osmium Catalyzed Alkene Bond Cleavage

Kyle Planck - Optimizing the Synthesis of Novel Pesticide Analogs and Evaluating Their Mosquitocidal Potential

Emily Scire - Enhancing Cytotoxic Chemotherapy Response through Targeted Inhibition of Angiogenesis in Preclinical Models of Cholangiocarcinoma

Caroline Sherry - Quantifying Diacetyl in Commercial Products with Paper Analytical Device

George Timmins - Total Synthesis of Pladienolide: A Potent Spliceosome Inhibitor for the Therapeutic Treatment of Niemann-Pick Type C Disease

Tiffany Toni - A Rhodium-Catalyzed Formal [4+1]-Cycloaddition Approach Toward the Stereoselective Construction of Quaternary Carbons

Albert Vargas - The development of a paper-based device for monitoring carbon monoxide

Kelly Volk - Characterization of Metastatic Genes of Interest AMIGO2 and TENM2 for Ovarian Cancer

Kristen Wehner - Novel correlation-based network analysis of breast tumor metabolism identifies the glycerol channel protein Aquaporin-7 as an inhibitor of breast cancer metastasis

Eric Young - Notre Dame Compound Curation

Emily Zion - Production and biological evaluation of the polyketide naphthocyclinone from the bacteria *Streptomyces arenae*

Schedule - Mathematics

Oral Presentations I — Jordan 310
1:00 - 2:30 p.m.

Moderator: Sonja Mapes

1:00 Tallis Bowers - Pricing European Options in Continuous Time
1:15 Sean Kent - Interest Rates: Models and Applications
1:30 Jeff Marino - One-Dimensional Dynamics & Milnor-Thurston Kneading Theory
1:45 Michael McCaffrey - Markov Chains and Applications

Poster Presentation — Jordan Galleria
2:30 – 3:30 p.m.

Ashley Ahimbisibwe - Testing Differential Privacy Mechanisms Through Monte Carlo Simulations

Schedule - Physics

Oral Presentations I — Jordan 322
1:00 - 2:30 p.m.
Moderator: Peter Garnavich
1:00 Elliott Runburg - The Control Software for the iLocater Spectrometer
1:15 Anders Flashnick - Optical Decoder Units: Construction and Testing of ODUs for use in the HCAL at CMS
1:30 Benjamin Cote - The Use of Visualization Methods in Track Reconstruction Studies for the Proposed CMS L1 Track- Trigger Upgrade
1:45 Louis Jensen - Designing and Building Components for the ND-Cube Detector
2:00 Sean Brudney - Graphitization of Carbon-based Material for Radiocarbon Dating
2:15 Elek Wellman - Electrical Plasmas for Biomedical Applications

Poster Presentations — Jordan Galleria
2:30 - 3:30 p.m.
Mark Egan - Thick-wall, Liquid-filled Quartz Capillaries for Wavelength Shifting Applications
Cameron Gorsak - The effect of varying phosphorus concentration on the semiconducting properties of $Ga_{1-x}Mn_xAs_{1-y}P_y$
Zachary Huber - R-Process Nucleosynthesis in Simulations of Binary Neutron Star Systems
David Kalamarides - Determining the effect of stellar evolution on carbon abundances
Tanner Leighton - Electron Studies for the Proposed CMS L1 Track Trigger Upgrade
Joseph Levano - Optimizing MicroMegas Design for Nuclear Experiments
Walter McLallen - Preparing for Isotope Harvesting at FRIB.
Walter McLallen - Construction of an Ion Beam Analysis Facility at Notre Dame.
Brady McLaughlin - [Re]Evaluating the Cost of Electricity due to Deaths at Hospitals with Unreliable Energy Systems
Allison Olshefke - Investigating the Relationship of Science Fair Participation on Students Perceptions of Science
Erik Peterson - Finding Bright Low-Metallicity Stars in the Milky Way Galaxy
Robert Stiller - FFT Analysis in Energy Systems for Smart Grid Control using Multiple Storage Devices

Oral Presentations II — Jordan 322
3:30 – 5:00 p.m.
Moderator: Peter Garnavich
3:30 Daniel Barabasi - Networks of the Brain: A predictive model of cortical connectivity based on a distance rule
3:45 Maciej Olszewski - Modeling Vortex Lattice Configurations in Superconductors by Molecular Dynamics Simulations
4:00 William Porter - Comparing the F-Spin Mass Model to Other Mass Models in the Z = 60 Range
4:15 Brandon Roach - Sensitivity of p-nuclei abundance calculations to statistical model parameters
4:30 Anne Stratman - Calculations of Absolute Transition Probabilities

Schedule – General Biology Laboratory Course

Poster Presentations — Jordan Galleria
2:30 - 3:30 p.m.

Schedule – Introduction to Research Course

Poster Presentations Jordan Galleria
2:30 - 3:30 p.m.

Yanting Luo, Anthony Smyth, Michael Sokolowski, Darius Yohannan, and Sarah Maazouz - Examination of the Synergistic Potential of 3-acetyl-11-keto-B Boswellic Acid (AKBA) and Curcumin on HT-29 Colorectal Cancer Cells

Schedule – Molecular Cell Biology Research Course

Poster Presentations — Jordan Galleria
2:30 - 3:30 p.m.

Jamie Campbell, Danielle Wales, Andre Monteleone, and Meridith Balbach - Investigation of adipocyte biomolecule utilization in an ECM-detached cancerous human mammary epithelial cell model

Schedule – Spirit of Science Award Winners

Poster Presentations Jordan Galleria
2:30 - 3:30 p.m.

Maddie Cerney - It's The Bomb! Using Bomb Calorimetry to Measure Calories.
Grace Jones - How Does Weather Affect Bacteria, Macroinvertebrates, and Natural Water Qualities?
Cole Klinedinst - Capacitors - How much energy can a Leyden jar store?
Maximilian Niebur - Effects of Corrosion on the Strength of Metals
Grace Weaver - The Effect of Fertilizer on Grass Growth
Jonathan Yang - Drink This but Not That.....

ABSTRACTS
(in alphabetical order)

Oral Presentation

Light manipulation of mosquito behavior: Acute and sustained photic suppression of biting activity in the *Anopheles gambiae* malaria mosquito

Dominic Acri
College of Science
Neuroscience and Behavior and Film, Television, and Theatre
Aaron Sheppard, Samuel Rund, Gary George, and Erin Clark, Dept. of Biological Sciences

Advisor: Giles Duffield, Dept. of Biological Sciences

Host-seeking behaviors in anopheline mosquitoes are time-of-day specific, with a greater propensity of biting occurring during the dark phase of the LD cycle. We investigated how a short exposure to light presented during the night or late day can inhibit biting activity. *Anopheles gambiae* s.s., maintained on a 12:12 LD cycle, were exposed to white light at the onset of night and the proportion taking a blood meal in a human biting assay was recorded every 2 hr for 8 hr. The pulse significantly reduced biting propensity in mosquitoes for up to 4 hr following administration, and with no differences detected after 6 hr. Conversely, biting levels were significantly elevated when mosquitoes were exposed to a dark treatment during the late day, suggesting that light suppresses biting behavior even during the late day. These data reveal a potent effect of a discrete light pulse on biting behavior that is both immediate and sustained. We expanded this approach to develop a method to reduce biting propensity throughout the night by exposing mosquitoes to a series of 10 minute pulses presented every 2 hr. We reveal both an immediate suppressive effect of light during the exposure period and 2 hr after the pulse. This response was found to be effective during most times of the night. However, differential responses that were time-of-day specific suggest an underlying circadian property of the mosquito physiology that results in an altered treatment efficacy. As mosquitoes and malaria parasites are becoming increasingly resistant to insecticidal and drug treatments, there is a necessity for the development of innovative control strategies beyond ITNs. These data revealing the potent inhibitory effects of light exposure and the utility of multiple photic pulses presented at intervals during the night/late day, may prove to be an effective tool that complements established control methods.

Poster Presentation

Testing Differential Privacy Mechanisms Through Monte Carlo Simulations

Ashley Ahimbisibwe, Claire Chow, and Evercita Eugenio
College of Science
Applied and Computational Mathematics and Statistics

Advisor: Fang Liu, Dept. of Applied and Computational Mathematics and Statistics

Our research focuses on the issue of data privacy, a research field that examines the dissemination of data, technology, the public expectation of privacy, and the legal and political issues surrounding them. If this privacy is not protected, people's personal information can be released resulting in potential harm to the individual. For example, the release of one's health information could result in higher insurance rates or refusal of insurance. Our research investigates the effectiveness of different mechanisms or algorithms that satisfies a privacy condition called differential privacy (DP). DP deals with the issue of statistical disclosure control, in which the goal is to reveal accurate statistics about a set of respondents while preserving the privacy of individuals. This privacy preservation is ensured by the addition of noise to the given data set given the sensitivity of the query. In doing this, the analyst or research can make valid statistical inferences or obtain fairly accurate statistical results about the data set while maintaining a predetermined level of privacy guarantee. The aim of the project is to evaluate different mechanisms that claim to be DP through Monte Carlo simulations to determine whether or not the mechanisms actually preserve DP. In particular, this project compares new proposed DP mechanisms against well tested mechanisms, such as the Laplace and exponential mechanism.

Poster Presentation

Transcriptional Regulation of Epithelial Membrane Protein 2 After APC Loss

Carolyn Ahlers
College of Science
Science Preprofessional Studies
Jenifer Prosperi, Indiana University School of Medicine – South Bend, Harper Cancer Research Institute, and Dept. of Biological Sciences
Alyssa Lesko, Dept. of Biological Sciences

Advisor: Jenifer Prosperi, Indiana University School of Medicine – South Bend, Harper Cancer Research Institute, and Dept. of Biological Sciences

The Adenomatous Polyposis Coli (APC) tumor suppressor functions as a scaffolding protein associating with the polarity proteins Dlg and Scrib, microtubules, and the actin cytoskeleton through its C-terminal domain. Our laboratory demonstrated that APC down-regulation in Madin-Darby Canine Kidney (MDCK) epithelial cells results in loss of apical-basal polarity and a disruption of 3D-morphogenesis resulting in larger, non-spherical cyst formation. Assessing the molecular mechanisms responsible for these phenotypes, we observed that APC knockdown increased expression of epithelial membrane protein 2 (EMP2). The transcriptional regulation of EMP2 is currently unknown, which prompted us to perform a screen using the Contra-V2 web server. We identified 32 potential transcription factors involved in EMP2 regulation, including TCF, activator protein 1 (AP1), signal transducer and activator of transcription 3 (STAT3), and NFκB. We next investigated the transcription factors altered upon APC loss using a DNA-protein array. This demonstrated that E2F-1 and STAT1 are upregulated upon APC loss. To investigate the mechanism by which EMP2 is upregulated in APCKD cells, we used luciferase reporter assays to determine activation of transcription factors that were present in both the Contra analysis and the DNA-protein array. We found that APC loss increases STAT3 reporter activity, but does not affect TCF, AP1 or NFκB transcriptional activity. To determine the downstream effect of EMP2 over-expression, we generated APCKDEMP2KD double knockdown and control cells over-expressing EMP2. Currently we are assessing whether rates of proliferation change when EMP2 is down regulated or overexpressed through proliferation assays. Additionally, we are investigating whether STAT3 inhibition affects EMP2 expression upon APC loss through real-time PCR. Given the prevalence of APC mutation in epithelial cancers, an understanding of how loss of APC mediates EMP2 will be critical for a more thorough understanding of initiation of tumorigenesis in epithelial cancers.

Poster Presentation

Benchmarking Empirical Force Fields for Ionic Liquids

Cecelia Allison
College of Science
Neuroscience and Behavior and Spanish
Steven Corcelli and Clyde Daly, Dept. of Chemistry and Biochemistry

Advisors: Steven Corcelli, and Clyde Daly, Dept. of Chemistry and Biochemistry

Previously created empirical ionic liquid force fields were examined using molecular dynamic simulations. Densities, diffusion constants, and conductivities were predicted at 298K and 353K for four ionic liquids: [Emim][BF4], [Emim][PF6], [Bmim] [BF4], and [Bmim] [PF6]. These values were compared to experiment and similar results derived form an ab initio force field as in McDaniel et al. Favorable comparisons were found (for instance, all density values had less than 8 % error when compared with experiment). Our favorable comparisons show that these force fields are useful for examination of ionic liquid properties, including dilute small molecule solvation.

Poster Presentation

T Cell Receptor Binding Orientation Effect On Downstream Signaling After Peptide Recognition

Michael Anderson
College of Science
Biochemistry and Theology
Jason Devlin and Nishant Singh, Dept. of Chemistry and Biochemistry
Sheena Smith, David Kranz and Dan Harris, Dept. of Biochemistry,
University of Illinois Urbana-Champaign, Urbana-Champaign, IL

Advisor: Brian Baker, Dept. of Chemistry and Biochemistry

Cellular immunity and new immunotherapeutic approaches rely on interactions between T-cell receptors (TCRs) and the peptide-major histocompatibility complex (pMHC) to initiate successful immune responses. Achieving peptide specificity by the TCR while simultaneously engaging the pMHC is critical for proper recognition and T-cell activation. Although early studies emphasized the role of CDR3Î± and CDR3Î² loops in determining antigen specificity, more recent work has shown that antigen specificity arises from a cooperative interplay between germline and hypervariable loops and the pMHC surface. To better understand the determinants of TCR specificity, we have been studying engineered variants of the human TCR A6, which recognizes the viral peptide Tax presented by the class I MHC HLA-A2, but has also been re-engineered to recognize the tumor associated antigen MART-1 with high specificity. An additional variant shows a surprising loss of specificity, recognizing a large range of structurally and chemically distinct peptide/HLA-A2 complexes. This change of specificity has caused the new TCR, RD1-MART1-High, to dock with a non-canonical binding orientation. Here we explore the possibility that the non-canonical binding causes a change in the downstream signaling of the T cell. To test this, a TCR whose binding affinity, kinetics and signaling are well characterized will be mutated to match the affinity and kinetics of RD1-MART1-High. These two TCRs will then be transduced into T cells in order to perform functional assays to see how the binding orientation effects TCR signaling.

Poster Presentation

Calcium Signaling in *Drosophila melanogaster* Ovaries

Louisa Antonelli
College of Science
Biological Sciences and Studio Art and Design

Advisor: Jeremiah Zartman, Dept. of Chemical and Biomolecular Engineering

As intercellular calcium waves have been reported in several developing organs in the larvae, including ovaries, Drosophila melanogaster provides an excellent study for comparison to the behavior of calcium waves in humans. For the purposes of observing and analyzing the calcium signaling patterns in D. melanogaster ovaries, UAS-GCaMP6f flies were crossed with both border cell GAL4 drivers and CY2-GAL4 flies to examine the calcium signaling during border cell migration as well as in follicle cells. The ovaries of these flies were then collected for imaging and analysis according to the protocol developed by Prasad et al. (2007). This study aims to develop a comprehensive analysis of tissues that exhibit intercellular calcium wave activity, as well as provide insight as to the connections between border cell migration and ovarian cancer, as border cell migration serves as a model for cell migration patterns in general.

Poster Presentation

APC regulation of tumor initiating cells in breast cancer

Anne Arnason
College of Science
Science Preprofessional Studies
Erin Howe, Harper Cancer Research Institute

Advisor: Jenifer Prosperi, Indiana University School of Medicine – South Bend, Harper Cancer Research Institute, and Dept. of Biological Sciences

An estimated 41,070 breast cancer deaths will occur in 2017, making it the second-leading cause of cancer death in women. Many of these deaths are caused by resistance to chemotherapy, for which stem cell-like tumor initiating cells (TICs) may be responsible. Therefore, understanding TICs is critical in developing effective breast cancer treatments. In up to 70% of sporadic breast cancers, Adenomatous Polyposis Coli (APC) is mutated or silenced by hypermethylation. Our laboratory demonstrated that cells from MMTV-PyMT;$Apc^{Min/+}$ mice are resistant to doxorubicin and cisplatin, and have increased populations of TICs compared to MMTV-PyMT;$Apc^{+/+}$ cells. This was studied via an Aldeflour assay that measures changes in aldehyde dehydrogenase (ALDH) activity. To understand what causes this increased TIC population, we found that MMTV-PyMT;$Apc^{Min/+}$ cells treated with a small molecule inhibitor of transcription factor STAT3 had a decreased $ALDH^+$ population compared to solvent control. In contrast, MMTV-PyMT;$Apc^{Min/+}$ cells treated with an inhibitor of FAK showed no change in $ALDH^+$ cells. Additionally, we studied how increased levels of ALDH translate to changes in tumor initiating potential. Using the mammosphere formation assay, we found no change in the mammosphere formation efficiency between MMTV-PyMT;$Apc^{+/+}$ and MMTV-PyMT;$Apc^{Min/+}$ cells. In addition to the murine derived cells, our laboratory uses the MDA-MB-157 human triple negative breast cancer cell line with lentiviral mediated shRNA to knockdown *APC*. We previously demonstrated that APC knockdown cells are resistant to cisplatin and paclitaxel. In contrast to the murine model, we showed no change in ALDH levels in *APC* knockdown cells compared to controls. We developed a gene signature of 225 genes altered in *APC* knockdown MDA-MB-157 cells compared to controls, and compared it to an existing TIC signature. The overlap between these two signatures contains 12 genes, five of which are changed in the same direction. Of these five genes, the downregulation of transcription factor GATA3 and upregulation of FKBP5 are most interesting. GATA3 is necessary for luminal epithelial cell differentiation, and its loss has been shown to lead cancer cells to acquire a TIC-like phenotype. In addition, FKBP5 has been previously linked to the development of taxane resistance in multiple cancer types. Therefore, future studies will focus on the interaction between GATA3 or FKBP5 and APC in regulation of the TIC population and development of therapeutic resistance.

Poster Presentation

Stronger Together: The role of cysteine residues in Ebola viral matrix protein VP40

Sarah Catherine Baker
College of Science
Biological Sciences and English
Kristen Johnson
College of Science
Biochemistry

Advisor: Robert Stahelin, Indiana University School of Medicine – South Bend
and Dept. of Chemistry and Biochemistry

Introduction: One hallmark of an intracellular Ebola infection is the formation of virus-like particles, or VLPs, on the extracellular surface of infected cells. The formation of VLPs is known to be facilitated by oligomerization of the viral matrix protein VP40. The tendency of VP40 to oligomerize into dimers, hexamers, and octamers is well-established, yet the mechanism of this oligomerization is not fully understood. An examination of the secondary structure of VP40 reveals the presence of only two cysteine residues, the positions of which are highly conserved across all five sub-species of Ebola virus. In the protein's fully-folded conformation, these cysteine residues would be solvent exposed in the dimer conformation. In the 4LDB VP40 crystal structure, these residues are shown to be at the interface of the VP40 tetramer.
Objective: We aim to better understand the role of the cysteine residues on VP40.
Methods: Site directed mutagenesis, protein purification, lipid binding assays, confocal imaging.
Results: When VP40 cysteines are reduced with DTT, lipid binding in-vitro is changed. We aim to understand how this affects VP40 function in cells my comparing WT VP40 and VP40 with cysteine to alanine mutations. Our preliminary data suggests that VP40 cysteine residues are important for protein function. Future work in cellular and lipid-binding assays with WT and mutant VP40 may shed further light on how the cysteine residues interact at the membrane, and analysis of wild-type proteins exposed to reducing agents may elucidate the importance of disulfide bonds specifically.

Poster Presentation

Adiposity and Microbiome Diversity in Mice Influenced by Gastrokine

Cayla Bales
College of Science
Biological Sciences
Anne-Marie Overstreet, Indiana University School of Medicine – South Bend

Advisor: David Boone, Indiana University School of Medicine – South Bend,
and Dept. of Biological Sciences

Gastrokine 1 is an 18kD protein produced in the stomach. Although its exact function is unknown, Gkn1 has been shown to promote gastrointestinal cell health and adiposity. It contains a BRICHOS domain, which may bind the amyloid fibers of some bacteria present in the gut. Our lab has created Gkn1-/- mice which exhibit a lean phenotype, but are otherwise healthy. In this study, we performed 16S rRNA gene sequencing of the small intestinal contents of WT and Gkn1-/- mice at three time points to determine the role of GKN1 on the gut microbiota. We found an increase in the class of bacteria known as Mollicutes at the later timepoints (12 weeks and 6 months). At these later timepoints, the WT mice were significantly heavier than their Gkn1-/- littermates. At 6 weeks, there was no difference in the body weights or Mollicutes abundance in either group. Comparisons using quantitative PCR of the small intestine mucosal layer were then performed for more detailed analysis and confirmation of preliminary sequencing results. Previous studies have shown that diet induced obesity caused by a high-fat Western diet resulted in a bloom of Mollicutes in mice. It has been suggested that members of the Mollicutes class have an increased capacity to metabolize carbohydrate types abundant in Western diet, such as glucose, fructose, and sucrose, for absorption by the host. This facilitation of calorie transfer possibly contributes to the increased adiposity. The smaller phenotype of Gkn1-/- mice and lack of Mollicutes bloom suggest that gastrokine 1 influences adiposity by impacting microbiome diversity.

Oral Presentation

Networks of the Brain: A predictive model of cortical connectivity based on a distance rule

Daniel Barabasi
College of Science
Physics

Advisor: Zoltan Toroczkai, Dept. of Physics

Updated experimental efforts using hemisphere-wide retrograde and anterograde tracing have provided large-scale static data about the architecture of the cortex. Previous studies of low-density interareal connectivity have found emergent scale-free and rich club properties as indicators of network heterogeneity, however these need to be revised due to the high-density nature of the cortico-cortico wiring reported in the recent experimental studies. To understand the level of specificity and connection heterogeneity of the cortical network one needs to take an alternative approach that is more suitable for dense, directed, spatial networks. Tracing experiments have revealed in both macaque and mouse brains the action of the so-called Exponential Distance Rule (EDR): an exponential decay of connection probability with distance. A simple, network model based on the EDR predicts many graph theoretical properties of the cortex. We introduced a simple core-periphery detection method based on clique distribution analysis, showing a strong core-periphery organization of the cortex in both macaques and mice when compared to appropriately chosen null-models. We further validated this method using stochastic block modeling analysis. To further probe the nature of the core-periphery, we generated a family of null-models based on the EDR under different assumptions for areal size distributions. All models start with a neuronal-level network based on the EDR, then the cortical sheet is parcellated at varying sizes. Our findings show that the cortical network cannot be modeled as a simple connectivity graph, but the network of connections, and implicitly the processes supported by it, are intricately tied with the functional parcellation of the cortex and the spatial / morphological properties of the cortical sheet.

Poster Presentation

Creating a Paper Analytical Device to Detect Low Quality Azithromycin-500 Tablets from Nepal

Aviyah Barstis
Saint Mary's College
Chemistry

Advisor: Toni Barstis, Dept. of Electrical Engineering

The World Health Organization (WHO) places Azithromycin as a worldwide essential medication used mainly for the treatment of bacterial infections. Azithromycin-500 is an antibiotic drug that contains 500-mg of the active pharmaceutical ingredient (API) Azithromycin. This research focuses on the creation of a paper analytical device (PAD) to screen for low quality or counterfeit Azithromycin-500 tablets. The PAD has been designed to contain colorimetric tests for the API and excipients found in genuine Azithromycin tablets as well as for substituted APIs and excipients found in low-quality or counterfeit Azithromycin tablets. One colorimetric test, a test that uses a concentrated sulfuric acid solution, was found to be semi-quantitative for Azithromycin: The intensity of the color change was directly related to the concentration of Azithromycin. The development of this Azithromycin PAD as well as the results obtained from local field tests using laboratory-created Azithromycin-500 samples and Azithromycin-500 tablets collected in Nepal will be presented.

Oral Presentation

Comparing heterogeneity in floodplain soils of restored two-stage versus unmaintained agricultural streams

Elizabeth Berg
College of Science
Environmental Sciences
Jennifer Tank and Brittany Hanrahan, Dept. of Biological Sciences

Advisor: Jennifer Tank, Dept. of Biological Sciences

Agricultural streams in the Midwestern U.S. are often managed (i.e., dredged) to maintain a trapezoidal shape with steep slopes, helping to move water quickly and efficiently downstream. However, channelization also removes natural floodplains, consequently decreasing bio-reactive surface area and limiting microbial processes including those that permanently remove excess nitrogen. The two-stage ditch is an in-stream restoration practice that constructs miniature floodplains within channelized ditches and creates a more stable system that requires less maintenance. Recent studies have found two-stage ditches also have the added benefit of enhancing stream ecosystem processes. The objective of our experiment was to compare floodplain soil characteristics in two contrasting reaches of an agricultural ditch (Shatto Ditch, Kosciusko Co., IN.): 1 downstream reach with a restored floodplain (i.e. two-stage) and 1 upstream reach that has not been maintained (i.e., "abandoned") for over 7 years. In each reach, we collected floodplain soil samples from 3 lateral zones (near-stream [NS], middle [MID], and upland [UP]) and quantified organic matter (%OM), carbon (C) and nitrogen (N) in soil samples. Overall, %OM, C, and N were 24%, 26%, and 31% higher in two-stage floodplain soil compared to unmaintained (ANOVA, $p<0.001$) indicating increased soil quality. Both C and N increased linearly with %OM suggesting that the vegetated floodplains of the two-stage ditch were promoting the build-up of high quality organic matter. Interestingly, soil quality in floodplains was extremely variable, especially in the NS and MD zones of each reach (CV>10%), mirroring the spatial heterogeneity found in floodplains of natural streams. Our results suggest that constructing in-set floodplains via the two-stage ditch improves floodplain soil quality enhancing the necessary elements for many critical stream biogeochemical processes, including ecosystem metabolism, respiration, and denitrification. Therefore, restoring the soil quality of these agricultural streams via two-stage ditch implementation is critically important to promote biogeochemical processing in these systems.

Oral Presentation

Pricing European Options in Continuous Time

Tallis Bowers
College of Science
Mathematics

Advisor: Alex Himonas, Dept. of Mathematics

We will discuss several common mathematical models used in finance to describe stocks and European options. These models include the binomial model of stock growth and options pricing, the log-normal model of stock growth, and the Black-Scholes-Merton model of options pricing. Binomial models are used to understand the financial instruments of interest to this discussion in discrete time. Most of this discussion focuses on understanding these instruments in continuous time, and the ultimate result is the use of stochastic calculus to derive the famed Black-Scholes-Merton equation. Time permitting, applications of this equation in the financial industry will be discussed briefly.

Poster Presentation

Engineering New *In Vitro* Angiogenesis Models

Bradley Bowles
College of Science
Biological Sciences
Adam Braegelman and Bradley Ellis, Dept. of Aerospace and Mechanical Engineering

Advisor: Pinar Zorlutuna, Dept. of Aerospace and Mechanical Engineering

Angiogenesis is a critical biological phenomenon that occurs in cancer and wound healing. Despite this, many current angiogenesis studies rely on expensive in vivo models or use in vitro assays that suffer reduced physiological relevance. This project developed alternative models of angiogenesis and wound healing to serve as test platforms for future cell biology studies. Gelatin methacrylate scaffolds of tunable stiffness were used to induce sprouting from human umbilical vein endothelial cells (HUVECS) in static and microfluidic culture environments. Microfluidic culture devices were manufactured using soft lithography, and were designed to recapitulate both the molecular gradients and the physical wall shear stresses experienced by endothelial cells in vivo. In order to provide a complementary platform for assaying angiogenesis ability without a reliance on 3D scaffolds, microfluidic technology was used to construct a two-dimensional, perfusable scratch assay. HUVEC monolayers grown within the devices were scratched and then monitored over an 18-hour recovery period to provide a model of vascular injury response. Results from the tube formation assays indicate that gelMA inhibits endothelial cell network formation regardless of VEGF treatment or seeding density. Similar results were observed in the microfluidic cell cultures, which successfully maintained molecular gradients and induced physiological shear stresses. Lastly, the two-dimensional, microfluidic scratch assays provided an alternative wound healing model characterized by high cell viability and quantifiable re-growth of the scratched area. These engineered microfluidic models provide effective alternatives to in vivo research and are promising platforms for future studies into cell adhesion, migration, or injury response.

Poster Presentation

Early Diagnosis of Osteonecrosis of the Jaw in Response to Bisphosphonate Therapy

Elise Brady
College of Science
Science Preprofessional Studies
Robert Wellendorf
College of Science
Biological Sciences
Steven White
College of Science
Science Business
Griffin Gilmore
College of Science
Biological Sciences
Jason Rink
College of Arts & Letters
Psychology
Kevin McAbee
College of Science
Biological Sciences

Advisor: Matthew Ravosa, Dept. of Biological Sciences

Bone resorption inhibitors, including bisphophonates (BPs), are the primary tools for managing bone metastases in cancer patients. BPs show significant efficacy in reducing bone pain, hypercalcemia and fractures for patients with metastatic bone disease from multiple myeloma or solid tumors (breast, prostate). Clinical data reveal a serious adverse event in cancer patients receiving IV BP therapy, osteonecrosis of the jaw (ONJ). ONJ is manifested by poor oral wound healing (particularly following invasive dental procedures), oral soft-tissue breakdown, and exposure and subsequent necrosis of underlying oral bone. Early stages of ONJ are difficult to diagnose and there is no effective treatment. We developed a rabbit model to assess changes in oral tissues resulting from BP therapy and oral wounding in humans. Three cohorts of 10 adult male rabbits each were established. Two BP-Treated groups were subjected to 7 monthly courses of IV BP treatment at 30-day intervals, while the Control group received saline infusions. In contrast to BP-Treated and Control groups, both of which were fed only chow, the BP-Elevated Loading cohort was fed a diet of chow supplemented daily with hay cubes. This latter diet facilitated analysis of the role of increased jaw loading on ONJ onset and progression. After 3 treatments over a 65-day period, all rabbits were subjected to unilateral removal of the right 1st mandibular premolar to simulate oral wounding in a human clinical setting. All subjects were then treated thrice more at 30-day intervals. Gingival tissues were removed post-mortem from the left and right sides and fixed prior to immunohistochemistry of proliferation, apoptosis, angiogenesis, and collagen and macrophage expression. Cellular staining intensity was quantified for gingiva near the tooth extraction and unaffected contralateral sites. Within- and across-cohort statistical comparisons indicate that the deleterious effects of BP therapy appear accentuated by tissue repair associated with oral wounding.

Poster Presentation

Role of Chaperone Protein, ERp29, in Insulin Trafficking and Maturation

Margaret Brecker
College of Science
Biological Sciences and Sociology
Yann Bikard and Laurence Suaud, Pulmonary Research, Children's Hospital of Philadelphia, PA
Christine Ferrara, Endocrinology, University of California San Francisco, CA

Advisor: Ron Rubenstein, Cystic Fibrosis Center, The Children's Hospital of Philadelphia, Philadelphia, PA

Dysfunctional protein folding in pancreatic beta cells may contribute to the development of both type 2 diabetes (T2D) and cystic fibrosis related diabetes (CFRD). Insulin folding and maturation is a tightly regulated process; however, a fundamental gap in our understanding of insulin biogenesis is the mechanism by which a pool of proinsulin is directed to the Golgi for processing and cleavage to insulin, while another pool remains unprocessed and is secreted as proinsulin. ERp29 is a luminal endoplasmic reticulum resident protein that is expressed ubiquitously in mammalian tissue. Our group previously demonstrated that ERp29 promotes biogenesis of both the cystic fibrosis transmembrane conductance regulator (CFTR) and the Epithelial Sodium Channel (ENaC). Interestingly, human insulin biogenesis parallels that of ENaC in its processing in the golgi. As human proinsulin contains a putative recognition motif for ERp29, 48F-F-Y50, we hypothesize that ERp29 interacts with proinsulin and helps direct proinsulin to the Golgi for cleavage. This hypothesis was initially supported by preliminary data demonstrating that overexpression of wild type ERp29 increased insulin secreted by INS-1 rat beta cells, while expression of a non-functional ERp29 (C157S) inhibited insulin secretion. To investigate the potential association of ERp29 and proinsulin in these cells we used a co-immunoprecipitation approach. Our data demonstrate that ERp29 co-precipitates, and therefore associates with both proinsulin and preproinsulin, consistent with our hypothesis that ERp29 regulates the maturation of insulin. Our group previously demonstrated that treatment of lung epithelial cells with 4-phenylbutyrate (4PBA) increases the expression of ERp29. We therefore investigated the effect of 4PBA treatment on INS-1 cells and found that incubation with 1 mM 4PBA resulted in an ~30% increase in ERp29 expression as early as 4 hours post-treatment. Interestingly, while 4PBA treatment appears to increase the total insulin content in pancreatic beta cells. Further investigation of the role of ERp29 in insulin processing could provide fundamental insight into the mechanisms of insulin biogenesis, while demonstrating whether or not ERp29 is a viable target for treatment of both T2D and CFRD.

Poster Presentation

Make no bones without it: Characterization of region-specific behaviors in non-sutural cranial osteoblasts using bone morphogenetic proteins

Justin Brill
College of Science
Biological Sciences
Holly Weiss-Bilka
College of Science
Biological Sciences
Matthew Ravosa, Dept. of Biological Sciences

Advisor: Matthew Ravosa, Dept. of Biological Sciences

Flexion of the basicranium is thought to be a consequence of encephalization in mammals, with a relatively larger brain posited to result in greater flexion and corresponding changes in facial form and position. While the basicranium serves as a key architectural interface between the developing brain and face, basicranial osteoblast (BoB) behavior has yet to be investigated. This hinders an understanding of the mechanistic basis of phenotypic variation in the formation of basicranial hard tissues. Characterizing basicranial development vis-à-vis cytokine signaling pathways, such as bone morphogenetic proteins (BMPs), will help elucidate targets of selection on skeletal morphology during primate and hominid evolution. Interestingly, BoBs do not respond to traditional osteogenic induction in cell culture. Perhaps this is because the basicranium forms endochondrally, which contrasts with other cranial elements that ossify intramembranously. Thus, BMP6 was chosen as an induction cytokine due to its presence in mineralizing cartilage during development. Primary BoBs were isolated from neonatal mice, then high-density micromasses were formed to mimic the in vivo cellular microenvironment. Micromasses (n=3) were treated for 4–6 weeks using osteogenic media with (treatment) or without (control) 100 ng/mL BMP6. Genetic analysis via qRT-PCR demonstrated significant (p<0.05) increases in the expression of hypertrophic and osteogenic markers with BMP6 treatment vs. controls. Similarly, histological staining revealed a proteoglycan-rich cartilaginous tissue at 4 weeks that was largely replaced by calcium-rich mineralized tissue by 6 weeks of BMP6 treatment. These findings identified BMP6 as a potent inducer of BoB mineralization via the native endochondral pathway, which indicates it may play a key role in basicranial development. Ongoing experiments to determine the specificity of BMP6 to bone formation in the basicranium vs. other craniomandibular sites suggest that ossification mode may be a critical ontogenetic determinant of oB behavior and, ultimately, developmental and evolutionary variation in the skull base.

Poster Presentation

Loss of MTSS1 results in increased metastatic potential in pancreatic cancer

Mary Brinkman
College of Science
Biological Sciences
Wei Huang and Ann Zeleniak, Dept. of Biological Sciences
Melissa Fishel, Indiana University School of Medicine – South Bend

Advisor: Reginald Hill, Dept. of Biological Sciences

Pancreatic ductal adenocarcinoma (PDAC) has a 5-year survival rate of 7%. This dismal prognosis is largely due to the inability to diagnose the disease before metastasis occurs. Tumor cell dissemination occurs early in PDAC. While it is known that inflammation facilitates this process, the underlying mechanisms responsible for this progression have not been fully characterized. Here, we functionally test the role of metastasis suppressor 1 (MTSS1) in PDAC. Despite evidence showing that MTSS1 could be important for regulating metastasis in many different cancers, its function in PDAC has not been studied. Here, we show that loss of MTSS1 leads to increased invasion and migration in PDAC cell lines. Moreover, PDAC cells treated with cancer-associated fibroblast-conditioned media also have increased metastatic potential, which is augmented by loss of MTSS1. Finally, overexpression of MTSS1 in PDAC cell lines leads to a loss of migratory potential in vitro and an increase in overall survival in vivo. Collectively, our data provide insight into an important role for MTSS1 in suppressing tumor cell invasion and migration driven by the tumor microenvironment and suggest that therapeutic strategies aimed at increasing MTSS1 levels may effectively slow the development of metastatic lesions, increasing survival of patients with PDAC.

Oral Presentation

The Dynamic Nature of Representations in Verbal Working Memory

Sarah Brown
College of Science
Neuroscience and Behavior
Nathan Rose, Dept. of Psychology

Advisor: Nancy Michael, Dept. of Biological Sciences

Verbal working memory investigation centers on the nature and location of mental representations for to-be-remembered information. The encoding of this information has the potential to manifest in many different forms, dependent on the differential encoding of information based on perceptual or conceptual stimuli, as well as the presence or absence of distraction. Representations may also differ in the course of memory with different representations for different stages of verbal working memory. New findings have constructed opposing theories to encompass these variables, focusing on the relationship between the brain regions of sensory perception, working memory, and long term memory in encoding, maintenance, and recall stages. This analysis uses MVPA data to break down the anatomical location of information maintenance and recall using varying levels of processing (LOP) and varying implementations of distraction. It directs participants to the perceptual or conceptual encoding of information under varying levels of distraction and correlates these conditions to their respective phonological or semantic mental representations. In MVPA, a classifier is trained using a subset of the collected data during different time points. Based on the encoding condition, MVPA creates a prediction from these values to model the rest of the data. The accuracy of this model is determined by comparing the prediction values to actual values. The recorded MVPA data shows high accuracy in LOP decoding, suggesting that information storage is indeed differentiated based on the LOP during encoding. This accuracy was only observed on the time point in which the classier was trained. This suggests a dynamic representation which differs maintenance and recall stages of verbal working memory. Future analyses based on these results have the potential to substantiate opposing models of verbal working memory.

Oral Presentation

Graphitization of Carbon-based Material for Radiocarbon Dating

Sean Brudney
College of Science
Physics

Advisor: Philippe Collon, Dept. of Physics

As part of an interdepartmental effort, the Accelerator Mass Spectrometry group in the Physics Department is collaborating with the Snite Museum of Art and the Department of Biological Sciences. The Site Museum has been provided a small collection of African art from the Congo and wishes to determine the age of several pieces and test for forgeries. The Department of Biological Sciences wishes to study the effects glacier ice melt has on local ecosystems by studying small insects living near runoff water. Both can be studied using radiocarbon dating to provide insights to authenticity of the art and the ecological effects of melting glaciers. Before the samples can be placed into the accelerator to be dated, they must be prepared by being converted into pure graphite. An explanation of how radiocarbon dating can be used in both cases will be provided and how the graphitization of the samples is performed will be summarized. Preliminary results will also be presented.

Oral Presentation

Investigating Phospholipid Binding Residues in the C terminus of Ebola Virus Matrix Protein, VP40

Melissa Budicini
College of Science
Biological Sciences

Advisor: Robert Stahelin, Indiana University School of Medicine – South Bend
and Dept. of Chemistry and Biochemistry

Ebola virus (EBOV) is a lipid-enveloped virus that causes hemorrhagic fever and a fatality rate of 50-90%. Though EBOV only has 7 genes in its genome, one, VP40 is the main driver of viral egress. VP40 localizes to the plasma membrane (PM) where it forms virus like particles (VLPs). While the mechanism of the viral egress is not completely understood, previous studies have found that phospholipids phosphatidylserine (PS) and phosphatidylinositol 4,5-bisphosphate (PIP2) are required for PM localization, self-oligomerization, VLP formation, and VLP budding from the cell. VP40 transforms through self-oligomerization from a dimer to a hexamer and eventually a longer filament. PS likely induces the dimer to hexamer transition while PIP2 binding is required for stability of larger oligomers. In an effort to understand the process of VP40 oligomerization, we have identified a likely PIP2 binding pocket on the C terminus of VP40; the C terminus of VP40 is hypothesized to interact with the PM. This pocket shares structural similarity to the PIP2 binding pocket of viral matrix protein HIV-GAG from HIV-1. We have implemented various methods both in vitro and through cell based assays. Site directed mutagenesis was used to make several potential PIP2 interaction residue and control residue mutations on the C terminus of VP40 for bacterial expression and EGFP-cellular expression. A liposome binding assay aided in identifying which residues are important for VP40 PIP2 binding in vitro. Next, VP40-EGFP WT and mutants were transfected into cells to determine the phenotype of each mutant. A live cell VP40-oligomerization assay, Number and Brightness, was used. This data revealed that some PIP2 binding deficient mutants also have a decrease in large oligomer formation, PIP2 is required for large oligomer formation of VP40. Finally, scanning electron microscopy was used to visualize VLP's on the surface of transfected cells. We have found that specific residues in the C-terminal domain of VP40 are required to bind to PIP2. Understanding how VP40 interacts specifically with PIP2 will help to better understand the mechanism of viral egress and identify a possible target site for drug development.

Poster Presentation

Effects of Lysophosphatidic Acid on Murine Peritoneal Tissue and Ovarian Cancer Cell Peritoneal Adhesion

Leigh Campbell
College of Science
Science Preprofessional Studies
Sharon Stack, Harper Cancer Research Institute and Dept. of Chemistry and Biochemistry
Yueying Liu, Dept. of Chemistry and Biochemistry
Brandi Bos
College of Science
Science Business
Yuliya Klymenko
College of Science
Biological Sciences

Advisor: Sharon Stack, Harper Cancer Research Institute and Dept. of Chemistry and Biochemistry

Epithelial ovarian cancer (EOC) metastasis occurs as tumor cells exfoliate from the primary tumor, permeate throughout the peritoneal cavity as single cells and multi-cellular aggregates (MCAs), adhering to the mesothelial layer of peritoneal tissues, inducing mesothelial retraction, submesothelial matrix invasion, and tumor mass proliferation. This process is accompanied by elevated levels of a signaling molecule lysophosphatidic acid (LPA) in ascites fluid. Our lab has shown that LPA disrupts junctional integrity and epithelial cohesion of EOC cells in vitro which may facilitate tumor cell extension from the primary carcinoma (Liu et al, 2012). However, the subsequent fate of free-floating cells/MCAs as well the microenvironmental response of host tissues to abundant LPA levels remains unclear. Thus, the objective of the current study is two-fold: to elucidate the effects of LPA on cancer cell/MCA dynamics and peritoneal adhesion, and to assess alterations in peritoneal tissue ultrastructure upon LPA exposure. Using a novel ex vivo tissue explant assay we report that LPA diminished the adhesive capacity of EOC cells to murine peritoneal explants in three different EOC cell lines. Further, EOC MCAs displayed significant changes in surface morphology with the loss of cell surface protrusions and poor cell aggregation, resulting in a higher number of disseminated small clusters compared to untreated control MCAs. Additionally, we found that peritoneal tissues from healthy mice injected intraperitoneally with LPA (versus those injected with phosphate-buffered saline or left untreated) demonstrated notably higher mesothelial surface microvilli density and length, as detected by scanning electron microscopy. Taken together, these findings support the hypothesis that LPA modulates EOC metastatic dissemination and ultimate metastatic success through alterations in both ovarian cancer cell/MCA behavior (aggregation and peritoneal adhesivity) and the intraperitoneal microenvironment (changes in host mesothelial morphology and susceptibility to metastatic anchoring).

Poster Presentation

Investigation of adipocyte biomolecule utilization in an ECM-detached cancerous human mammary epithelial cell model

Jamie Campbell
College of Science
Biological Sciences
Danielle Wales
College of Science
Biological Sciences
Andre Monteleone
College of Science
Biological Sciences
Meridith Balbach
College of Science
Biological Sciences

Advisors: Zachary Schafer, and Chelsea McCallister, Dept. of Biological Sciences

Elucidation of metastatic processes is crucial to development of therapies targeting metastasizing cells, thus preventing tumorigenesis. Typically, metastasizing cells first detach from the extracellular matrix, triggering a cell death pathway called anoikis. However, a number of pro-survival signaling pathways are used by metastasizing cells to prevent anoikis. Even with evasion of cell death, metastasizing cells face a significant obstacle: unavailability of traditional energy sources. New findings that carcinoma-associated fibroblast secretions inhibit anoikis suggest that other cell types present in the stroma could contribute factors that facilitate cancer survival and invasion. Recent studies suggest that adipocytes correlate with a greater survival of metastasizing cells, potentially due to a reprogramming of metabolism enabling utilization of fatty acids as a primary energy source. However, the mechanism by which this occurs is poorly characterized. Because breast cancer cells are exposed to adipocyte-rich stroma early in the metastatic process, this study aims to compare the metabolic processes of cancerous epithelial breast cells overexpressing the oncogene ErbB2 (MCF-10A:ErbB2) and the wild-type cells overexpressing the anti-apoptotic protein Bcl2 (MCF:10A-Bcl2). To determine the effect of adipocyte secretions on the ability of cancer to evade anoikis, the cells were grown in ECM detachment. Furthermore, the study aimed to characterize whether cancerous cells are able to more efficiently utilize biomolecules from adipocyte-secreted media, modeling adipocytes in the tumor stroma. A cell growth assay was used to confirm that cancerous cell lines demonstrate greater viability when cultured in adipocyte-conditioned media. To confirm the hypothesis that increased energy contributes to greater viability in cancerous cells, an ATP assay comparing ATP production levels was performed. To investigate hypothesized higher beta-oxidation pathway activity in cancerous cells, a Western blot of acetyl-CoA carboxylase was conducted. To determine glucose transporter activity, immunofluorescence was performed to compare relative localization of glucose transporters. Finally, a ROS assay was performed to investigate whether cancerous cells are able to utilize fatty acids via the beta-oxidation pathway because of increased ability to eliminate ROS.

Poster Presentation

Function and Stability of Gastrokine 1

Erin Carmody
College of Science
Biological Sciences
Katie Adlaka
College of Science
Science Business
Anne-Marie Overstreet, Indiana University School of Medicine - South Bend

Advisor: David Boone, Indiana University School of Medicine – South Bend
and Dept. of Biological Sciences

Gastrokine 1 (GKN1) is an 18 kDa mucosal protein produced exclusively in the antrum of the stomach. It is highly conserved across mammalian species. Although the function of GKN1 has not been elucidated, it does contain a BRICHOS domain that may facilitate binding of this protein to microbes. We have generated Gkn1-/- mice that exhibit a lean phenotype but are otherwise healthy. We would like to complement these mice with GKN1 to determine its function. We are using two different methods for this purpose. In the first method, we isolated crude GKN1 from porcine stomachs. To assess the stability of porcine GKN1 in drinking water, lyophilized protein was resuspended in H2O at room temperature, with aliquots taken twice a week. A Western blot was performed and revealed that GKN1 degrades over time. These results indicate that weekly changes of the lyophilized protein in drinking water would be sufficient to feed back GKN1 to the knockout mice. The second method used was to produce recombinant mouse GKN1 using the pKLAC2 vector in *Kluyveromyces lactis*. Using mouse cDNA and specially designed primers, GKN1 was introduced into the pKLAC2 vector and transformed into competent *Escherichia coli*. Selected clones were grown and the pKLAC2-Gkn1 plasmid was extracted. The plasmid was linearized prior to transformation into *K. lactis*. Acetamide was used to select for integration of the plasmid into the genome. *K. lactis* colonies were then used to inoculate broth cultures. After four days of incubation, the supernatant was collected. The protein was immunoprecipitated, and a Western blot was performed to assess the presence of GKN1. We were able to show that multiple colonies produced GKN1, indicating successful integration of GKN1 into the yeast genome. In the future, this should lead toward the use of recombinant GKN1 in multiple assays to assess the function and biological significance of this protein.

Poster Presentation

It's The Bomb! Using Bomb Calorimetry to Measure Calories

Maddie Cerney
Saint Matthew Cathedral School

Purpose: Different foods have different Calorie counts. Can I obtain reasonably accurate results using a homemade bomb calorimeter?
Hypothesis: Calorie counts on nutrition labels can be verified within a 5-10% deviation using a homemade bomb calorimeter.
Results: My results were not as I anticipated and therefore my hypothesis could not be proven within the parameter that I set. The bomb calorimeter that I constructed could not produce accurate results due to the loss of heat that was unable to be captured and measured. Also, I was unable to burn the food completely because I could not provide a constant pure oxygen supply. After my first round of testing, I did further research and made modifications to my calorimeter based on the attributes of an actual bomb calorimeter. My second round of testing produced a 12% decrease in percentage error compared to the first round. This increased accuracy in results leads me to believe that were I able to perform the experiment using an actual bomb calorimeter that I could replicate, within a reasonable deviation, the Calorie count per the nutrition label on a given food to be tested.

Poster Presentation

Investigating the species-specific growth responses of Midwestern Oaks to drought conditions

Jacklyn Cooney
College of Science
Environmental Sciences
Kelly Heilman, Dept. of Biological Sciences

Advisor: Jason McLachlan, Dept. of Biological Sciences

Ecosystem responses to climate change may depend on species-specific reactions to extreme climate conditions, such as drought. Particularly, tree growth responses to drought events may vary by species due to different life history strategies and present forest composition. Therefore, by understanding how various species will respond to droughts, we can predict how forests will respond to future climate change. To better understand species-specific responses, we measured and analyzed early and late annual growth of Bur Oak (*Quercus macrocarpa*) and White Oak (*Quercus alba*) from Northeastern Illinois. We compared species-specific growth responses to Palmer Drought Severity Index (PDSI) between 1895-2014, and investigated long term effects of severe droughts by comparing species-specific tree growth before and after the 1934 Dust Bowl drought. We hypothesized that the Bur Oak would be more resilient to drought conditions than the White Oak, as it is often found in drier locations on the landscape. Further, we hypothesized that drought legacy would drive multiple years of decreased growth in species recovering from the 1934 drought event. Analysis showed a positive trend between tree growth and PDSI for both species, indicating growth was limited by drought conditions, as well as an interaction between drought conditions and species (Two-Way ANOVA, p-value <0.01). The slopes were significantly different, with White Oak having a higher sensitivity to times of severe drought (t-Test, p-value <0.01). Bur Oak had significantly greater annual growth than White Oak between 1915-1953 (Two-Way ANOVA, p-value <0.05). Further, there was a difference in annual growth before and after the drought (Two-Way ANOVA, p-value <0.01), with Bur Oak having no significant difference in growth (t-Test, p-value <0.05) and White Oak having increased growth after the drought (t-Test, p-value <0.01). This suggests that while Bur Oak was less affected by the drought, pre-drought conditions were poor for White Oak growth, driving a species-dependent response to drought. These species-specific growth responses suggest growth is dependent on both climate and species composition, and gives insight in how forest compositions could adapt in response to future drought events.

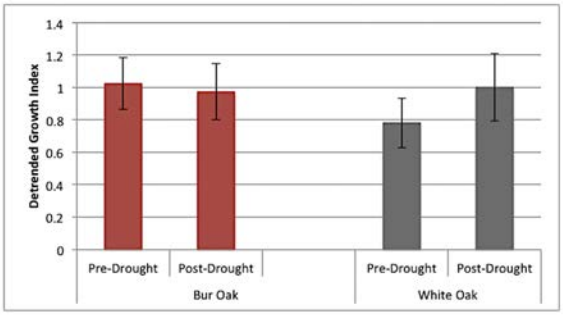


Figure 1. The detrended growth index for Bur and White Oak before and after the 1934 Dust Bowl drought. There was a significant difference in growth for the two species (Two-Way ANOVA, p-value < 0.05). Further, there was a significant difference in pre- and post-drought growth, with increased growth for White Oak after the drought event (Two-ANOVA, p-value < 0.01; t-Test, p-value < 0.01).

Oral Presentation

The Use of Visualization Methods in Track Reconstruction Studies for the Proposed CMS L1 Track- Trigger Upgrade

Benjamin Cote
College of Science
Mathematics and Physics

Advisors: Kevin Lannon and Michael Hildreth, Dept. of Physics

In order to undertake experiments with higher energy proton collisions, the Large Hadron Collider (LHC) at CERN in Geneva, Switzerland is scheduled for an update in the near future. With these higher luminosity events, there will be an addition of glancing collisions that produce signals in the detector which are uninteresting. These signals, known as pileup, are challenging for the Compact Muon Solenoid (CMS) detector and, thus, the CMS detector must be upgraded to accommodate it. This upgrade includes the implementation of a Level-1 (L1) Track Trigger. This L1 Track-Trigger is composed of field-programmable gata array (FPGA) technology which implements a track reconstruction algorithm. The research conducted involves an FPGA emulation code which runs over simulated events in order to characterize the anticipated performance of this L1 Track-Trigger. When this code fails to reconstruct tracks, or reconstructs tracks which do not correspond to real charged particles, it is often difficult to identify the source of the problem. As such, the origin of difficulty is theorized and speculated, then tested by changing the corresponding aspects of the code. Using visualization methods is an extremely useful tool to test the outcomes of these subtle changes. Thus, this research primarily focuses on the use of these methods to sort out and characterize the problems in track reconstruction as performed by the emulation code. In doing so, troublesome events can be better understood and the algorithm can be adjusted to better handle them.

Oral Presentation

The Role of Context Dependency in Mercury Contamination of Pacific Salmon in the Laurentian Great Lakes

Sean Cullen
College of Science
Environmental Sciences
Brandon Gerig and Gary Lamberti, Dept. of Biological Sciences

Advisor: Dominic Chaloner, Dept. of Biological Sciences

Non-native salmonids, including Pacific salmon (*Oncorhynchus* spp.), were introduced to the Great Lakes in the 1960s where they have since developed into a major recreational sport fishery supported by hatchery stocking and wild reproduction. However, recent population declines have compelled state agencies to consider alternatives, such as Atlantic salmon (*Salmo salar*). One challenge for future stocking efforts of salmon is biotransport of contaminants, including mercury, by these migratory fish species into tributaries where they spawn and die. While mercury concentrations have decreased in the Great Lakes, mercury remains a persistent pollutant in the environment. Mercury accumulates in food webs via biomagnification, and rates of bioaccumulation can be influenced by growth rates, trophic position, and rearing location of fish. We examined the dependence of mercury accumulation in Great Lakes salmon on biological, physical, and chemical factors associated with the environmental context. Tissue samples were taken from fish collected from four Great Lakes (Huron, Michigan, Ontario, and Superior). Fish were also measured for length, weight, and sex. Tissue samples were homogenized and analyzed for mercury and stable C and N isotopes for trophic position. Chinook salmon (*O. tshawytscha*) were 10% more contaminated with mercury than coho salmon (*O. kisutch*), which was explained by their larger size and higher trophic position. Atlantic salmon mercury concentrations were similar to those of coho. Salmon from Lake Michigan were the most contaminated with mercury in comparison with those from the other three lakes. Our results suggest that fish size, species identity, trophic position, and rearing location all influence mercury contamination in Great Lakes salmon. Understanding the process by which salmon become contaminated with mercury in the Great Lakes will be key in predicting and mitigating mercury contamination of fish consumed by humans.

Poster Presentation

Antimicrobial Resistance in Red Oak Acorns

Patrick Cunniff
College of Science
Biochemistry

Advisors: Jeanne Romero-Severson, Depts. of Biological Sciences and Robert Stanley, Depts. of Biological Sciences and Chemistry and Biochemistry

When red oak acorns (*Quercus rubra*) fall from their trees, squirrels often bite the tops off the seed before burying them, leaving the lipid and carbohydrate rich inside of the acorn exposed. These acorns are able to survive months in the soil despite the prevalence of bacteria and fungi present in the soil, some of which come from the same families as human pathogens, which indicates the presence of an internal chemical defense mechanism in the acorns. This experiment will determine which compounds present in red oak acorns display these antimicrobial properties, and to identify and classify these compounds. The red oak acorn powder was extracted using a gradient of solvents of increasing polarity and the extract was separated through Medium Pressure Liquid Chromatography (MPLC) and High Pressure Liquid Chromatography (HPLC) to isolate individual compounds from the acorn extract. The isolated fractions were tested for antimicrobial properties and fractions with the antimicrobial properties were further separated. Liquid Chromatography Mass Spectroscopy (LCMS) was run on these fractions showing that these compounds were not tannins, a group of compounds found in acorns that also exhibit antimicrobial properties, the usual expectation for these results. Future work will both isolate and characterize these compounds using Mass Spectroscopy (MS) and Nuclear Magnetic Resonance (NMR), and determine their levels of activity though methods including activity assays and minimum inhibitory concentrations (MICs).

Oral Presentation

The Role of SUMOylation During Cardiac Development in *Xenopus laevis*

Hannah Dakin
College of Science
Biochemistry
Paul Huber, Dept. of Chemistry and Biochemistry
Olivia Cox
College of Science
Biochemistry
Kyle Dubiak
College of Science
Biochemistry

Advisor: Paul Huber, Dept. of Chemistry and Biochemistry

Congenital heart defects are the most common form of birth defect, leading to more deaths during the first year of life than any other congenital anomaly. SUMOylation is a post-translational modification in which the small polypeptide, SUMO, becomes covalently attached to a target protein. Several transcription factors that are involved in heart formation are SUMOylated, and instances of congenital heart defects have been tied to disruption of this post-translational modification. This study aimed to examine the role of SUMOylation during cardiac development in Xenopus laevis embryos. In order to accomplish this, transgenic embryos were created that express the protein Gam1 specifically in cardiac tissue at different stages of development. Gam1 inactivates SUMOylation activity by triggering the destruction of one of the enzymes (E1) in the conjugation pathway. The Gam1 transgenic animals exhibited a variety of developmental heart defects, including Iaterality, outflow tract, and septation defects, ventricular noncompaction, and an abnormality akin to Tetralogy of Fallot. In order to study the very earliest steps in heart formation we are using whole mount in situ hybridization to track migration of myocardial progenitor cells to the ventral midline to form the cardiac crescent and its subsequent division into two lineages, the first heart field (FHF) and second heart field (SHF). DIG-labeled probes complementary to two genes, Nkx2.5 and Tbx20, that are highly expressed in progenitor cells, are used to identify these cells in the embryo. Embryos are microinjected with mRNA encoding Gam1 in order to suppress SUMOylation activity; embryos injected with water serve as controls. Initial results show that suppression of SUMOylation affects the migration and fusion of the two precardiac regions, preventing or delaying the formation of a single cardiac (crescent) region. Therefore, a regulatory role for SUMOylation in heart development appears to begin in precardiac mesoderm of gastrula stage embryos.

Poster Presentation

Structural Characterization of TIL 1383i to Reengineer Specificity and Affinity

Lauren Davancaze
College of Science
Biochemistry
Nishant Singh
College of Science
Biochemistry

Advisor: Brian Baker, Dept. of Chemistry and Biochemistry

TIL 1383i is a CD4+ derived T cell receptor that targets the human tyrosinase peptide (hTyr) overexpressed in primary and metastatic melanoma. This makes it an attractive platform for TCR-based gene therapy via adoptive cell transfer (ACT), where patient T cells are genetically engineered to express TCRs that respond specifically to melanoma associated antigens and then reintroduced into patients. Using this model, TIL 1383i is currently being used in clinical trials to treat melanoma patients. Preliminary results from a phase I clinical trial in which patients received autologous CD4+ T cells transduced with TIL 1383i showed partial tumor regression in some patients, suggesting that this therapy has clinical potential yet room for continued development. Previous clinical trials with other TCRs have shown correlation between binding affinity of TCRs and higher immunogenicity. In an ongoing effort to improve the immunogenicity of the TIL 1383i, I intend to engineer variants of TIL 1383i with higher affinity and specificity towards the target antigen. Structure guided design (SGR) is an in-silico technique that uses the structural information of the TCR and the antigen complex to generate higher affinity variants of the TCR. Towards this goal, I aim to crystallize and solve the structure of TIL 1383i bound to hTyr to find evidence for unique structural binding motifs responsible for eliciting an immunogenic response against melanoma tumor cells. Understanding of these essential structural characteristics of TIL-1383i binding can act as a guide for engineering optimized higher affinity variants, with the intention of serving as immunotherapeutic agents that can potentially improve clinical outcomes in melanoma treatment.

Poster Presentation

Chemosensation in a Pest Fly, *Drosophila suzukii*

Kathleen Davin
College of Science
Biological Sciences

Advisor: Zainulabeuddin Syed, Dept. of Biological Sciences

Over the course of evolution, insects have adapted to detect, distinguish, and respond to the most critical and informative odors in their particular environments through olfaction and its associated neural pathways. In Drosophila olfaction is mediated by two major olfactory organs, the antennae and the maxillary palps. The role of antenna has been thoroughly studied (Scheidler et al., 2015), however, the role of the palps in mediating odor-induced behavior remains untested. I conducted choice assays with flies by selectively ablating either, or both, antennae and palps. I used host-derived yeasts as odor sources. Preliminary data revealed that the palps contribute to, but are not sufficient in, mediating odor preferences. In order to further investigate the finer details of odor-induced behavior, I used a four-arm olfactometer. This device is divided into four zones that are continuously flushed with clean and humidified air. One of the arms can be replaced with experimental odor. Separation of the four zones can be visualized by a smoke plume. Flies showed an overall increase in their movement and sustained directed movement towards the arm infused with odors. I will present the data from these two independent experiments and discuss the implications.

Poster Presentation

APC loss promotes early tumorigenic phenotypes in MCF10A mammary epithelial cells

Gabrielle C. Davis
College of Science
Science Business

Advisors: Jenifer R. Prosperi, Indiana University School of Medicine – South Bend, Harper Cancer Research Institute, Dept. of Biological Sciences, and Alyssa C. Lesko, Dept. of Biological Sciences

Breast cancer is the most commonly diagnosed cancer and second leading cause of cancer- related death among women in the United States. The scaffolding protein Adenomatous Polyposis Coli (APC) is a tumor suppressor lost in many epithelial cancers including colorectal, lung, pancreatic, and breast cancer. Although *APC* is mutated or hypermethylated in up to 70% of sporadic breast cancers, depending on the subtype, the role of APC in early breast cancer development is unknown. Using the Madin-Darby Canine Kidney (MDCK) model, our laboratory has shown that APC regulates multiple cellular events implicated in cancer development. Specifically, APC knockdown led to large, filled-in cysts with inverted polarity in 3D culture and increased migration. The goal of this project is to translate these findings from MDCK cells to MCF10A mammary epithelial cells, and to more precisely model early development of human breast cancer. Using CRISPR/Cas9 genome editing to knockout APC in MCF10A cells, we investigated multiple *in vitro* tumorigenic properties. First, because chronic cell growth and division is a hallmark of cancer, we assessed cell size, proliferation, and the cell cycle profile. These studies showed that cell size and proliferation increased upon APC knockout, while there was no change in the cell cycle profile. Additionally, acinar morphogenesis and polarity programs that are responsible for proper cellular orientation can be disrupted in cancer, so we looked at the size and appearance of APC knockdown acini and stained for markers of apical-basal polarity. We found that APC knockout acini exhibited abnormally uneven, rough surfaces, an increase in size, and inverted polarity. The data collected suggest a role for APC loss in early mammary tumorigenesis. Ongoing studies on epithelial membrane protein 2 (EMP2) expression in APC knockout cells will provide insight into the molecular mechanism leading from APC loss to the tumorigenic and metastatic phenotypes observed in this study. Increased knowledge of the molecular basis of breast cancer will reveal novel therapeutic targets for combating tumors characterized by APC loss.

Poster Presentation

Developing a PAD to Screen for Low-Quality Albendazole

Heather DiLallo
College of Engineering
Chemical Engineering
Toni Barstis, Dept. of Electrical Engineering

Advisor: Toni Barstis, Dept. of Electrical Engineering

Parasitic worm infestations are common to children of developing countries, and are considered to be a roadblock to the social and economic development of these countries. These effects range from mild (e.g., discomfort, diarrhea) to life-threatening (e.g., anemia, malnutrition, or death). Albendazole is a commonly used oral medication for the treatment of parasitic worm (e.g., tapeworms, roundworms, hookworms, and pinworms) infestations. Because albendazole is a safe and effective medication, the World Health Organization (WHO) placed albendazole, a benzimidazole carbamate anthelmintic, as an essential medicine, meaning that all people should have access to albendazole in sufficient amounts at all times. Unfortunately, in developing countries such as Nepal, the quality of this essential medicine is suspect. In an extensive sample collection study in Nepal in summer 2016, Barstis found that albendazole was often stored improperly (e.g., open to the heat and humidity) and given past its expiration date. This research focuses on the development of a paper analytical device (PAD) to screen for low-quality albendazole. These PADs are about the size of business cards, use colorimetric chemistry to screen for select ingredients, and results can be seen in less than five minutes. The "albendazole PAD" contains colorimetric tests (e.g., a redox reaction with n-bromosuccinimide (NBS) and iron(II)) that were found to be semi-quantitative for the concentration of albendazole. This colorimetric chemistry test, the PADs, and the results of local (laboratory-created samples) and international (Nepali samples) field tests using the PADs will be presented.

Poster Presentation

Effect of Lipid Disruptions on Translational Stop Codon Readthrough in *Mycobacterium marinum*

Samuel Eallonardo
College of Science
Biological Sciences
Rachel Bosserman
College of Science
Biological Sciences

Advisor: Patricia Champion, Dept. of Biological Sciences

The combination of certain genetic alterations in the pathogen *Mycobacterium marinum* is known to increase the readthrough of stop codons during translation. The genetic changes, a 12 base-pair insertion in ppsc, a lipid synthesis gene, and overexpression of MMAR_0039, an acetyltransferase, lead to readthrough of a nonsense mutation in eccCb1, a ESX-1 secretion system component. Such readthrough causes complementation of the attenuating nonsense mutation and restores virulence. This study charecterizes the limits the readthrough phenotype by creating lipid disruptions using genetic knockouts of ppcs, mas, another lipid synthesis gene, and drr, a lipid transporter, and overexpressing MMAR_0039 using an integrating plasmid. The effects of such alterations were characterized in both a wild type strain and a strain containing an eccCb1 nonsense mutation. While the lipid disruptions were found to affect cell permeability, none were sufficient to complement eccCb1 and restore virulence.

Poster Presentation

Thick-wall, Liquid-filled Quartz Capillaries for Wavelength Shifting Applications

Mark Egan
College of Science
Science Business

Advisor: Randal Ruchti, Dept. of Physics

The use of quartz capillary tubes containing waveshifting liquid is an effective way to measure light output in particle detectors. These detectors will be exposed to significant levels of potentially damaging radiation. This experiment seeks to optimize the type and concentration of waveshifting liquid that will exhibit both radiation hardness as well as longitudinal uniformity. Capillary tubes are tested in a light-tight box with an LED, emitting at 425nm, placed at increments of 10mm along the axis of the tube while light output is measured at one end using a P/N diode. Thus far, the experiment has proven that certain levels of irradiation can decrease longitudinal non-uniformity as well as increase overall light output. Ultimately, these capillary tubes would be used inside a Shashlik Electromagnetic Calorimeter to gather light produced by scintillation crystals and provide an optical path for this light to be measured by a photosensor at one end.

Acknowledgement of Support: Mark Vigneault, Department of Physics and Kiva Ford, Notre Dame Radiation Laboratory

Poster Presentation

Effect of Metabolic Stress on Chlorfenapyr Efficacy using a Novel Flight-Stress Apparatus

Kenneth Elkin
College of Science
Biological Sciences
John Grieco and Nicole Achee, Dept. of Biological Sciences

Advisors: Nicole Achee and John Grieco, Dept. of Biological Sciences

The current use of pyrethroid chemicals in bed nets and indoor residual sprays to control malaria vectors is becoming increasingly ineffectual due to widespread insecticide resistance. Chlorfenapyr, a halogenated pyrrole, is a non-pyrethroid insecticide currently under evaluation by the World Health Organization to overcome this challenge. Chlorfenapyr acts metabolically via the uncoupling of oxidative phosphorylation to adenosine triphosphate production, which leads to cellular death and subsequent insect mortality. Due to Cholorfenapyr's metabolic, non-contact mode-of-action, existing Centers for Disease Control (CDC) and World Health Organization (WHO) bioassay protocols that are used to evaluate efficacy of vector control chemicals are currently unsuitable. Subsequently, there is an imperative need to develop an effective method for evaluating Chlorfenapyr. In this study, we propose a novel assay procedure in which metabolic stress is induced by forced flight in mosquito test populations prior to exposure to predetermined doses of Chlorfenapyr. We hypothesize that as metabolic stress increases, the effectiveness of Chlorfenapyr will also increase. The authors intend the results from this study to contribute to guidance on standard protocol development for evaluating Chlorfenapyr and other non-pyrethroid insecticides with similar modes of action thereby improving efficacy evaluation for use in malaria vector control.

Poster Presentation

Research of Novel Insecticides

Alexander Ellyin
College of Science
Science Business
Zoe Loh
College of Science
Biochemistry

Advisor: Mary Ann McDowell, Dept. of Biological Sciences

Mosquitoes are the most deadly animals on the planet, killing nearly a million people every year and affecting millions more. One species with a large impact is *Aedes aegypti*, which spreads viruses such as dengue fever, yellow fever, chikungunya, and Zika. With Zika having such a large impact on the world recently, the need for new insecticides has never been greater. This research concerns the development of novel insecticides that affect the female *Ae. aegypti*, which transmit disease. The main focus of our research is the use of G-protein coupled receptors as insecticide targets. Formamide compounds, which have been used as pesticides, affect G-protein coupled receptors, namely octopamine receptors. A formamidine compound being tested here is LG-8 and its analogs. A modification of the WHO susceptibility test is used to test the effectiveness of the formamide compounds on mosquito mortality. Female mosquitoes are placed in vials containing filter paper impregnated with compound for a contact time of either one hour or 24 hours. For vials where the mosquitoes were under a one-hour contact, the mosquitoes were transferred to vials with untreated contact paper after the initial treatment. Knockdown numbers were recorded after one hour, two hours, and 24 hours.

Poster Presentation

Using Transgenic *Aedes aegypti* Mosquitoes to Generate Aaop1 Visual Mutants by CRISPR/Cas9 Mutagenesis

Ryan Engert
College of Science
Science Preprofessional Studies
Maddison Staff
College of Science
Biological Sciences

Advisors: Joseph O'Tousa and Michelle Whaley, Dept. of Biological Sciences

Aedes aegypti is the mosquito vector for dengue fever, yellow fever, and Zika virus that are responsible for diseases with a major impact on global human health. Our laboratory seeks to understand the importance of the visual system in mosquito behaviors that can be exploited in novel vector control strategies. In this project, we use the CRISPR-CAS9 system to knock out Aaop1, the major rhodopsin in the adult eye. Our goal is to create a mutant mosquito line with limited visual capability that then will be analyzed for behavioral traits and vector competence. The current study involves crossing two transgenic lines to generate the desired visual mutant. One line is carrying the 3XP3-DsRed containing homology-directed repair (HDR)/Aaop1 gRNA cassette flanked by 3XP3-ECFP and pU6-gRNA components incorporated into its genome. The second line produces the EYFP marked Cas9 protein, which is responsible for making the double stranded cut in the targeted DNA sequence. After mating these two lines, some of the resulting F1 offspring will have the necessary genetic material to cause homology directed repair, which introduces a frame shift in the Aaop1 gene. The F1 offspring that have all the necessary genetic components to undergo HDR will carry three fluorescence markers for ECFP, DsRed, and EYFP. The positive F1s will then be crossed with a white-eyed wild-type (Wh) line to result in F2s that are visually impaired and only contain the DsRed fluorescent marker. Cre recombinase can be microinjected into the embryos of F2 offspring to remove the DsRed component. The behavior of these F2 animals can be assessed in visual and vector competence assays as compared to wild-type. Future studies will involve the knocking-out of other opsins.

Oral Presentation

Optical Decoder Units: Construction and Testing of ODUs for use in the HCAL at CMS

Anders Flashnick
College of Science
German and Physics

Advisors: Mitchell Wayne and Daniel Karmgard, Dept. of Physics

At the Large Hadron Collider in Geneva, Switzerland, proton beams with center-of-mass energy $\sqrt{s}$=14 TeV counter-rotate around a ring. The Compact Muon Solenoid (CMS) is a general-purpose, multi-layer detector, which is used to analyze the particles resulting from the proton beam collisions. Each subsystem of CMS is composed of layered detectors of varying forms, which measure the properties of particles as they pass through the layers. The hadron calorimeter is one such subsystem and is made up of layered plates of brass or steel and scintillating material. The signals from these scintillators are gathered in optical decoder units, which sum the energy deposited over a given volume before sending the signal to be amplified and recorded. The main components of an ODU are bunches of fiber optic cable, which must be able to effectively transmit light from scintillators to photomultipliers. Test stands were designed to test both the transmission of individual fiber optic bunches and the ODUs themselves. Input light was split between a control measurement and the fiber optic bunch or ODU, and the resulting values were analyzed using Python to determine the efficacy of the ODU. Over time, the hardware behind these test stands has decayed significantly, resulting in a need for a new design. Advances in electronics technology allow for a streamlined and simplified design: a Raspberry Pi is used as the human interface to an Arduino, which drives a printed circuit board (PCB).

Poster Presentation

Tumor-induced stromal STAT1 deregulates the mammary tissue homeostasis and accelerates breast cancer development

Sarah Fracci
College of Science
Biological Sciences
Victoria Zellmer, Dept. of Biological Sciences

Advisor: Siyuan Zhang, Dept. of Biological Sciences

Breast cancer (BC) is the most common form of cancer among women of all races in the United States, followed by lung cancer and colorectal cancer (Center for Disease Control and Prevention, 2016). The tumor microenvironment (TME) is the functional ecosystem immediately surrounding the malignant tumor cells that is composed of a heterogeneous mix of endothelial cells of the blood and lymphatic circulation, stromal fibroblasts and a variety of bone marrow-derived cells (BMDCs) including macrophages, myeloid-derived suppressor cells (MDSCs), and mesenchymal stem cells (MSCs) (Joyce and Pollard, 2009).While previous research has focused in on the effects of the TME on the outgrowth of a breast cancer tumor, this study focuses in on the tumor-induced changes in the adjacent tissue stroma. We sought to elucidate potential tumor-induced morphological and molecular changes in the surrounding TME. Results of this study show that the tumor adjacent mammary glands display altered branching morphology, and enriched mammary gland stem cell populations and other alterations. Through meta-analysis, STAT1 was identified as the potential regulator in this crosstalk between the tumor and the tumor adjacent tissue. In a proof-of-concept in-vivo experiment, co-treatment with a STAT1 activation inhibitor and a general chemotherapy drug demonstrated enhanced therapeutic efficacy. The results of this study demonstrate that STAT1 may play a role in the vicious cycle of breast tumor progression.

Poster Presentation

Investigation of Neuropeptide F as a Novel Insecticide Target

Kaitlin Frei
College of Science
Biological Sciences

Advisors: Douglas Shoue and Mary Ann McDowell, Dept. of Biological Sciences

Vector-transmitted diseases, such as Malaria, Zika virus, and West Nile virus, result from the transfer of pathogens and parasites from one organism to another. As many vector-transmitted diseases have no cure, the major method of combat is vector-control efforts. Unfortunately, attempts at combatting infectious diseases are not fully successful due to increased resistance. Consequently, new insecticides that act by alternative pathways must be discovered. G-protein coupled receptors (GPCRs) are one group of potential novel insecticide targets since they are highly druggable. One GPCR of interest is the invertebrate neuropeptide F receptor (NPFR) and its associated ligand since it is known that the NPFR affects food intake and digestion in Drosophila. This study investigates the use of the neuropeptide F (NPF) GPCR and its associated ligand as a potential target for controlling vector-borne diseases in *Aedes aegypti* mosquitoes. In doing so, RNA interference was used to knockdown the NPF receptor and ligand through the injection of dsRNA. Knockdown was quantified using quantitative Real-Time PCR and feeding behavior was assessed using a sugar-feeding assay. A correlation between NPF receptor knockdown and decreased sugar feeding was seen, suggesting that NPF receptors are valid insecticide targets. To further validate NPF receptors as potential targets the relationship between NPF receptor knockdown, blood feeding, and reproduction should be investigated.

Poster Presentation

Fluorescent Exosome Engineering and Imaging

Anne Gandolfi
College of Science
Science Preprofessional Studies
Yong Cheng, Dept. of Biological Sciences

Advisor: Jeffrey Schorey, Dept. of Biological Sciences

Exosomes are nanoscale membrane vesicles with a size between 50 to 150 nm produced by most nucleated cells in multicellular organisms. These vesicles play critical roles in the pathology of human diseases, including tuberculosis, one of leading cause of mortality due to an infectious disease in the world. In our lab, we previously identified Mycobacterium tuberculosis (M.tb) proteins in exosomes from macrophages infected with M.tb, the causative agent of tuberculosis. In recent studies, Ag85A-DsRed, a fluorescent fusion protein containing M.tb protein Ag85A and fluorescent protein DsRed, was detected in exosomes from macrophages infected with M.tb overexpressing Ag85A-DsRed. However, we failed to detect the Ag85A-DsRed signal in live host cells by fluorescent microscopy likely due to its low expression in M. tb. In order to follow proteins as they are trafficked to multivesicular bodies and exosomes, we aimed to generate four recombinant fusion proteins in E. coli, add the purified proteins to macrophages, and compare the proteins in their effectiveness in labeling exosomes.
To deliver DsRed into exosomes, two leading proteins, M. tb Ag85A and HIV Nef protein, were used. Both proteins have been detected in exosomes released from host cells infected with M. tb and HIV, respectively. We hypothesized that Ag85A-DsRed and Nef-DsRed fusion protein would also be trafficked to exosomes. We engineered and purified from E. coli two versions of the recombinant Ag85A fusion protein; Ag85A-DsRed (native Ag85A and DsRed) and mAg85A-DsRed (Ag85A lacking the transmembrane domain and DsRed). In addition, Nef-DsRed and DsRed only were expressed in E. coli. These four DNA fragments were cloned into protein expression vector pET-15B using fast cloning from the plasmid pMV261-Ag85A-DsRed or pMV261-Nef-DsRed, and the resulting plasmids were transformed into the E. coli strain BL21 for protein expression. The fusion proteins were purified using nickel ion affinity chromatography and added into macrophage cultures. The exosomes were purified from the cultures and quantified using Nanosight. Western blots were performed to determine the presence of the fusion proteins in the exosomes and the whole cell lysates. Fluorescent microscopy was also used to visualize the presence of fusion protein in the exosomes and whole cell lysates.

Poster Presentation

miR-543 in Myelofibrosis

Matthew Goblirsch
College of Science
Chemistry and Philosophy
Elizabeth Torres Claudio, Unversity of Puerto Rico Medical Sciences, San Juan, PR
Diadette Ramos Ramirez, Ponce Health Sciences University, Ponce, PR
Oscar Wu, Texas Tech University, Lubbock, TX

Advisors: George Calin and Enrique Fuentes Mattei, MD Anderson Cancer Center, Houston, TX

MicroRNAs (miRNAs) are small noncoding RNA molecules. Recent studies have found that some of these molecules can act as biomarkers in certain cancer types. It is important to identify and study such biomarkers, both for clinical cancer detection purposes and for development of a greater understanding of how the various cancer phenotypes are manifested. This study sought to identify and examine a miRNA biomarker in myelofibrosis, a cancer of the bone marrow. It was determined that miR-543 and miR-382 were upregulated in this disease. Following the identification, miR-543 was selected and studied to discern its role. Results indicated that miR-543 alters the levels of several proteins involved in myelofibrosis, including TET1 and TET2. Furthermore, miR-543 was shown to increase overall DNA methylation.

Poster Presentation

Effects of Diet and Seasonality on Parasite Burden in Yellow Baboons of the Amboseli Ecosystem

Claire Goodfellow
College of Science
Biological Sciences

Advisor: Elizabeth Archie, Dept. of Biological Sciences

Seasonal differences in parasite burdens are common in tropical primates. However, because food resource availability typically changes with season, it is unknown whether observed patterns in relative parasitism between the dry and wet seasons are more due to seasonal weather changes or to the foods themselves for which individuals forage at different time points. Here, I test the hypothesis that reduced diet diversity (and therefore, increased reliance on "fallback" foods such as grasses) predicts increased parasite load in individual baboons. In order to test this hypothesis, I will analyze foraging data collected as part of a long-term study on a group of yellow baboons (*Papio cynocephalus*) living in the Amboseli Ecosystem, a semi-arid short-grass savannah ecosystem located in East Africa. Focal sampling data ranging back to 2011 will be used to measure individual diets, and will be analyzed in conjunction with fecal parasite data collected using standard parasitological techniques. My hypothesis will be supported if I observe a significant increase in common parasites (Trichuris, Strongyles, Abbreviata) of individuals with a large dietary proportion of "fallback foods" such as grass corms, tree gum, and grass bases compared to individuals whose diets are composed of a higher proportion of high return foods, controlling climate variables (e.g. temperature and rainfall). Through answering questions such as this one, we can gain a greater understanding of how primates cope with extreme and dynamic environments, essential information to understanding the widespread potential impacts of climate change on the health of wildlife populations.

Poster Presentation

Exploring the influence of benthic substrate on biofilm growth in experimental streams at ND-LEEF

Nicole Gorman
College of Science
Environmental Sciences
Brittany Hanrahan, Dept. of Biological Sciences
Elizabeth Berg
College of Science
Environmental Sciences
Jennifer Tank and Arial Shogren, Dept. of Biological Sciences

Advisor: Jennifer Tank, Dept. of Biological Sciences

Stream biofilms colonize benthic surfaces of all types and are well studied in the context of biogeochemistry, but the interplay between substrate, hydraulics, and patterns in biofilm colonization remain understudied. We explored the interaction between substrate composition and biofilms over two summers in four 50m experimental streams with contrasting substrate composition at the Notre Dame Linked Experimental Ecosystem Facility (ND-LEEF). The four streams varied only in substrate lining each channel, representing varying size (gravel vs. cobble) and heterogeneity (alternating sizes vs. well-mixed). We used repeated sampling over time to examine biofilm accumulation at two different timescales: in 2015 we sampled 6 times over 158d of growth, and in 2016 we sampled over 32d. During both summers, we found that biofilm colonization was substrate-specific, but spatially and temporally heterogeneous. While biofilm biomass generally increased over time in all streams, even over short time scales, biofilm accumulation also included significant reach-scale patchiness. These results suggest a strong linkage between biofilm character and underlying substrate, and should be considered when exploring the impact of the physical environment on the ecology of natural streams.

Poster Presentation

The effect of varying phosphorus concentration on the semiconducting properties of $Ga_{1-x}Mn_xAs_{1-y}P_y$

Cameron Gorsak
College of Science
Physics
Xiang Li
College of Science
Physics

Advisor: Jacek Furdyna, Dept. of Physics

As the computation era progresses, we must continue to develop new technologies (and thus new materials on which these technologies rely) in order to maintain the pace set by Moore's Law. One class of materials with great promise in this context is the family of ferromagnetic semiconductors based on the alloy $Ga_{1-x}Mn_xAs$. It has been recently discovered that, if one alloys $Ga_{1-x}Mn_xAs$ with phosphorus to form the quaternary $Ga_{1-x}Mn_xAs_{1-y}P_y$ system, its ferromagnetic properties (such as the orientation of the magnetic easy axis and its Curie temperature) can be "tuned" by varying y. In order to investigate this process, crystalline samples of $Ga_{1-x}Mn_xAs_{1-y}P_y$ were grown using molecular beam epitaxy (MBE), as follows. Beams of Ga, Mn, As and P were emitted from corresponding effusion cells with their fluxes controlled by the cell temperatures. By this means, we have grown a series of alloys with the same value of x (kept at x = 0.06), but with different phosphorus concentrations. After MBE growth, the samples were annealed at 270°C in order to improve their homogeneity and to increase their Curie temperatures (T_C), below which the specimens become ferromagnetic. We monitor the sample composition by X-ray diffraction (XRD), which yielded the values of y = 0, 0.103, 0.150, 0.212, 0.236 and 0.302 for our sample series. Once the samples are prepared, they are then cleaved in the form of rectangles, then contacts are attached by soldering to prepare them for magneto-transport experiments, which serve for determining the values of T_C, magneto resistance, and anomalous Hall effect. Our experimental data show a negative correlation between the concentration of phosphorus, y, and T_C, as seen in Fig. 1. Our measurements also reveal that the magnetic easy axis rotates from in-plane orientation to out-of-plane as y increases, as illustrated by Fig. 2, which shows clear hysteresis loops when the applied field is normal to the film plane. Finally, the anomalous Hall results indicate that the coercivity (i.e., the magnetic "hardness") of the samples increases quite dramatically with increasing y, as seen in Fig. 3.

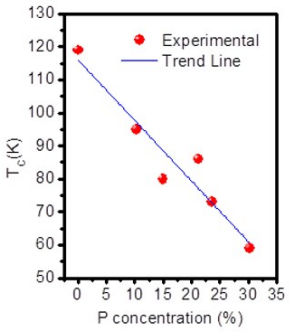


Fig. 1. Decreasing T_C with increasing P concentration.

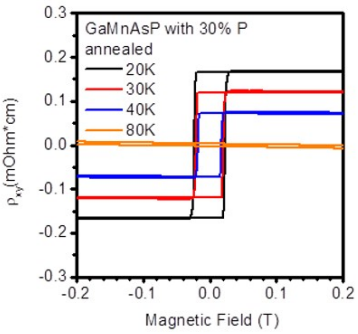


Fig. 2. Hall resistivity of GaMnAsP film with y = 0.30 at different temperatures.

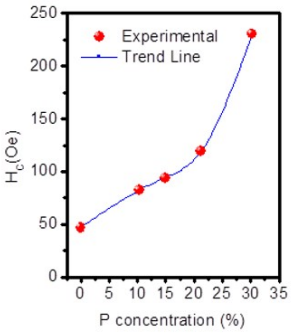


Fig. 3. Increasing H_C with increasing P concentration.

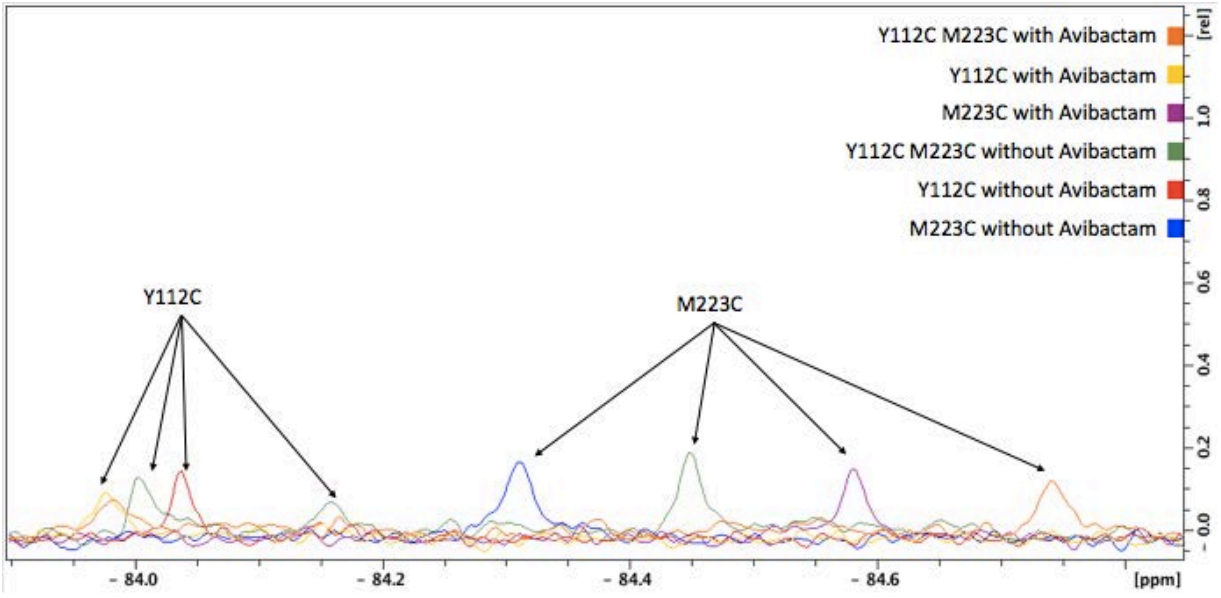
Poster Presentation

Investigating the Dynamic Loops of OXA‐24/40 using ^{19}F NMR Spectroscopy

Sarah Graney
College of Engineering
Chemical Engineering
Erin Graney
College of Science and Arts and Letters
Biological Sciences and Sociology

Advisors: Michael Staude and Jeffrey Peng, Dept. of Chemistry and Biochemistry

OXA-24/40 is a carbapenem hydrolyzing class D β-lactamase (CHDL) found in the resistant gram-negative pathogen, *Acinetobacter baumannii*. Previous studies identified two loops which form a hydrophobic bridge covering the active site of the protein. Point mutations identified two specific amino acids, Tyr-112 and Met-223, which play a crucial role in the ability of the enzyme to hydrolyze carbapenems. In order to characterize the inherent dynamics and response to binding of substrates and inhibitors, point mutations were performed at these sites replacing the native amino acids with cysteine to allow for fluorine labeling. Three protein constructs were generated; one with a Y112C substitution, one with a M223C substitution, and one with both Y112C and M223C substitutions. After purifying mutant proteins, small fluorinated molecules were attached to the cysteine side chains allowing for 19F studies of these sites of interest. Observation of 19F chemical shift perturbations of these mutants tagged with 3-Bromo-1,1,1-trifluoroacetone (BTFA) molecules report directly on the chemical environment of these sites. Introduction of the non- β-lactam β-lactamase inhibitor, avibactam, to the fluorinated OXA-24/40 samples illustrates the sensitivity of the 19F chemical shifts to inhibitor binding as shown in the figure below. This sensitivity would allow for development of a high-throughput screening platform for new β-lactamase inhibitors.



Poster Presentation

Intraperitoneal tumor selection identifies potential mediators of ovarian cancer metastasis

Anne Grisoli
College of Science
Neuroscience and Behavior
Siyuan Zhang and Chunyan Li, Dept. of Biological Sciences
Jing Yang, Dept. of Chemistry and Biochemistry
Xuejuan Tan, Dept. of Biological Sciences
Zonggao Shi and Yueying Liu, Dept. of Chemistry and Biochemistry
Kelly Volk
College of Science
Biochemistry
Eric Lee
College of Science
Science Business

Advisor: Sharon Stack, Harper Cancer Research Institute and Dept. of Chemistry and Biochemistry

To develop improved therapies targeting metastasis, a better understanding of molecular mediators in ovarian cancer cells is necessary. In order to better understand changes in gene expression in highly metastatic ovarian cancer cells, a strategy of intraperitoneal (IP) tumor selection was used to isolate variants with enhanced metastatic potential. Two RFP-transfected, human ovarian cancer cell lines, OVCAR5 and OVCAR8, were injected IP into groups of female nude mice and allowed to proliferate. Tumors were explanted and RFP-labeled cancer cells were cultured, incubated, and reinjected into another group of mice for proliferation. This process was repeated three times, resulting in isolation of cells with enhanced IP metastatic potential (termed IP cells). After this in vivo malignant cell selection, gene expression in the initial OVCAR5 and OVCAR8 cell lines was compared to the IP-selected cells using “Drop-seq” single-cell RNA sequencing. This microfluidics technique uses a barcode to identify single cells in droplets for genome-wide mRNA sequencing. This study focuses on six genes selected from Drop-seq results and current literature. A metastasis suppressor, KiSS1, was downregulated in IP-selected cells. Several extracellular matrix-related genes, collagen type VI alpha 3 (COL6A3), and podocalyxin-like (PODXL), showed differential expression in parental and IP-selected cells. Other genes selected for further analysis include SEC11C, a subunit of the signal peptidase complex that has been linked to cell migration and invasion, PAX8, a transcription factor previously associated with thyroid cancers, and IFI6, which has been associated with apoptosis regulation. Gene expression analysis with qPCR supported the initial Drop-seq results in five of the six selected genes. These experiments demonstrate that in vivo selection for ovarian carcinoma variants with enhanced metastatic potential is an effective screening method for possible molecular mediators. Future studies with immunocytochemistry will compare gene product expression between parental and IP-selected cells.

Poster Presentation

Foretinib, a c-Met / VEGFR inhibitor, augments chemotherapy response in preclinical models of gastric cancer

Meghan Grojean
College of Science
Neuroscience and Behavior
Niranjan Awasthi, Roderich Schwarz, Margaret Schwarz,
Indiana University School of Medicine – South Bend and Dept. of Chemistry and Biochemistry
Urs vonHolzen, Sazzad Hassan, Sheena Monahan, Indiana University School of Medicine – South Bend

Advisor: Niranjan Awasthi, Indiana University School of Medicine – South Bend
and Dept. of Chemistry and Biochemistry

Gastric adenocarcinoma (GAC) is the second most common cause of cancer-related death worldwide. The epirubicin, cisplatin, and 5-fluorouracil regimen or its modifications are generally considered the reference standard for GAC patients, promoting a median survival of 8-10 months. Nab-paclitaxel (NPT), a next generation taxane, shows antitumor activity in preclinical GAC studies. In GAC, several growth factor receptors including c-Met and VEGFR, are overexpressed and provide a therapeutic target. Foretinib is a novel small molecule inhibitor of the c-Met and VEGFR pathways. We evaluated efficacy of foretinib to enhance antitumor response of NPT in preclinical models of GAC. In subcutaneous xenografts, NPT and foretinib therapy inhibited tumor growth, while NPT plus foretinib caused an additive effect. Net tumor growth in different therapy groups was 581.7 mm3 in controls, 397.9 mm3 after oxaliplatin, 229.9 mm3 after NPT, -82.6 mm3 (tumor regression) after foretinib, -74.1 mm3 after oxaliplatin+foretinib and -96.3 mm3 after NPT+foretinib. No significant change in body weight was observed for mice treated with nab-paclitaxel, oxaliplatin or foretinib. In GAC peritoneal dissemination model, median animal survival compared to controls (23 days) remained unchanged after oxaliplatin therapy (24 days) but increased after NPT (42 days, 83% increase) or foretinib (46 days, 100% increase). Further increased animal survival was observed in combination therapy groups: oxaliplatin+foretinib (55 days, 139% increase) and NPT+foretinib (76 days, 230% increase). In vitro studies demonstrated inhibition in proliferation by NPT and foretinib, and NPT+foretinib caused an additive effect. Immunoblot analysis revealed that foretinib pre-incubation blocked HGF-induced expression of phospho-c-Met. Foretinib treatment caused decreased phosphorylation of AKT, ERK and PLC-γ, either alone or in combination with nab-paclitaxel. These findings suggest the antitumor effect of chemotherapy can be significantly enhanced by the c-Met/VEGFR pathway inhibitor foretinib, which might be a clinically relevant therapeutic combination to increase survival of GAC patients.

Poster Presentation

The transcription factor mecom acts upstream of the tbx2a/b T-box factors to specify distal nephron patterning in the zebrafish pronephros

Nicole Handa
College of Science
Biological Sciences
Bridgette Drummond
College of Science
Biological Sciences

Advisor: Rebecca Wingert, Dept. of Biological Sciences

Formation of distinct segments in the zebrafish pronephros relies on intricate combinations of spatial and temporal gene expression during development. mecom, a transcription factor expressed in a subset of renal progenitors, is required for distal segment formation. However, as with many of the other genetic factors involved in nephron patterning, how Mecom acts to fulfill its role is unknown. To investigate other aspects of this regulatory network, we explored the relationship between mecom and the tbx2a/b genes, which were recently demonstrated to be essential for distal segment development. Using whole mount in situ hybridization and confocal imaging analysis, we found that mecom is coexpressed with tbx2a/b in renal progenitors. Next, we performed loss of function studies to investigate the epistatic relationships between mecom and tbx2a/b. While knockdown of mecom was associated with reductions in the expression domains of tbx2a and tbx2b in renal progenitors, embryos that were tbx2a/b deficient had normal mecom expression. These studies are consistent with the hypothesis that mecom acts upstream of tbx2a/b expression to control distal tubule patterning. Rescue experiments using tbx2a/b overexpression to restore nephrogenesis in mecom deficient embryos are currently underway. To date, our results suggest that mecom acts through tbx2a/b to pattern the distal late segment in the pronephros, thereby contributing knowledge about the essential components involved in nephron patterning. Future studies to elucidate direct targets of Mecom, and other genes involved in this pathway, are needed to develop a more precise understanding of the signaling required for proper distal tubule development.

Poster Presentation

An Examination of the Efficacy of Iodoplatinate towards the Detection of Various Types of Pharmaceutical Products and Recommendations for the Reagent's Use in Paper Analytical Devices

Alec Helmke
College of Arts & Letters
History and Science Preprofessional
Tracy-Lynn Cleary, Dept. of Chemistry and Biochemistry

Advisor: Marya Lieberman, Dept. of Chemistry and Biochemistry

To combat the pressing issue of illicit drug abuse, we are developing a paper card that can detect the presence of narcotics in samples of street drugs. Our recent research centered on the qualitative investigation of potassium iodoplatinate (I_6K_2Pt), an ionic salt formed by mixing potassium iodide (KI) and hexachloroplatinic acid (Cl_6H_2Pt), towards detecting the tertiary amines found in most narcotics. Previous research contrasted the efficacy of multiple different recipes of the reagent for visualizing narcotics on thin layer chromatographic (TLC) plates and examined the effect of co-reagents on the sensitivity and specificity of the reagent (Fringe and Queen, 1973). Paper Analytical Devices (PADs) are made of cellulose and wax, which are sensitive to strong acids and hydrophobic solvents. Since many color tests common to TLC plates involve these compounds, they often do not translate well to the PAD. We endeavored, as such, to compare the recommendations listed in the earlier research to see which worked best on the PADs. I found that adding hydrochloric acid (HCl) to the iodoplatinate made the reagent take on a darker, more robust color, and, similarly, adding p-toluenesulfonic acid (p-TosOH) to the test lanes resulted in the iodoplatinate/amine ion pair taking on a much darker brown color when applied to PADs. The iodoplatinate/p-TosOH lane was tested at the Berrien County Forensic Laboratory, where illicit drugs including heroin, crack cocaine, and a fentanyl simulant all gave strong positive results. Additionally, both of the modified iodoplatinate reagents were stable on the PAD for at least a week. These findings, with further investigation in the field, could provide a vital tool towards preventing illicit drug abuse.

C.S. Fringe, C.A. Queen. 1973. Evaluation of Thirteen Iodoplatinate Reagents for the Qualitative Detection of Drugs of Abuse. Clinical Chemistry. Vol. 19: 664-665.

Poster Presentation

Seasonal Dynamics of Host Parasite Load in Yellow Baboons

Abigail Herman
College of Science
Science PreProfessional

Advisor: Elizabeth Archie, Dept. of Biological Sciences

In tropical mammals, hosts typically bear higher parasite burdens in the wet season as opposed to the dry season. Although this trend is evident, what has not been explored is the dynamics of change and stability observed within each season itself. In our research, we investigate the interplay between host vulnerability and parasite transmissibility that influence these dynamics of change. We test the hypothesis that changes in parasite transmissibility are more important than changes in host vulnerability to parasites by looking at the dynamics of parasite load change in Amboseli Baboons. We predict that, in the wet season, parasite loads will decline rapidly because of reduced exposure due to rainfall removing parasite infectious stages. In the dry season, we predict that parasite load increases rapidly at the beginning of the season, maintains a steady level for some time, and then begins to decline towards the end of the dry season due to the fact that parasites are unable to effectively transmit after a long period of no rain. In order to test this hypothesis, we will test how parasite load fluctuates throughout the seasons for baboons, controlling for other factors known to explain inter-individual differences in parasitism. We will draw our data from a long-term data base which uses parasite count techniques of sedimentation and sugar-flotation. Our hypothesis will be proven correct if what we have predicted is observed in the data. Looking at the dynamics of change rather than just the overall seasonal trends will give us a greater understanding of the relationship between the susceptibility a host has for infection and the parasite's ability to transmit effectively.

Poster Presentation

Interactive Consumption of Salmon and Non-Salmon Resources by Resident Fishes during Great Lakes Pacific Salmon (*Oncorhynchus* spp.) Spawning Events

Nathan Hermann
College of Science
Biological Sciences
Gary Lamberti and Brandon Gerig, Dept. of Biological Sciences

Advisor: Dominic Chaloner, Dept. of Biological Sciences

Introduced Pacific salmon (*Oncorhynchus* spp.) migrate into Great Lakes tributaries where, during mass spawning, they deposit eggs and dislodge invertebrates when building redds. Where salmon are native, resident fish such as rainbow trout (*Oncorhynchus mykiss*) have interacted with this resource pulse for some time. In the Great Lakes, introduced brown trout (*Salmo trutta*) and native brook trout (*Salvelinus fontinalis)* have only experienced Pacific salmon runs for almost 60 years. We analyzed these resident fish's diets to evaluate their resource overlap during the spawning pulse. Fish stomach contents were collected using gastric lavage before and during spawning migrations in eight Lake Michigan tributaries and then sorted to determine composition by mass. We tested whether the mass of salmon and non-salmon resources in diets was influenced by timing (before or during salmon runs), location (with or without salmon runs), or resident species identity (brook, brown, or rainbow trout). Results showed that location ($p<0.001$) and timing ($p<0.001$) were significant factors in mean diet mass, while their synergistic interaction ($p<0.001$) suggested that salmon spawning increased diet mass 14-fold, largely due to egg consumption. Whole diet increase varied by species ($p=0.04$), with brown trout consuming double and triple the mass of brook and rainbow trout respectively during salmon spawning. For non-egg resources, neither timing ($p=0.50$) nor location ($p=0.08$) were significant factors in consumption. However, the interaction was significant ($p=0.03$), suggesting salmon increased the availability of non-salmon items to resident fish, although this did not differ among species ($p=0.08$). Overall, our results suggest that consumption of food resources by stream-resident fish was influenced, directly and indirectly, by the presence of salmon and indicate a resource overlap in the diets of resident fish species. This work on feeding interactions in the context of non-native salmon has important implications for understanding the impacts of introductions on native species.

Oral Presentation

The Role of the Fibrinolytic System in Hypertensive Renal Injury

Kristina Hollkamp
College of Science
Biochemistry

Advisors: Francis Castellino and Victoria Ploplis, Dept. of Chemistry and Biochemistry

Hypertension is a prevalent health issue in the United States and around the world. Approximately 75 million American adults, over 30% of the U.S. population, suffer from hypertension. Despite these numbers, the effect of the fibrinolytic system in hypertensive renal injury is still poorly understood. This study investigates the effect of the fibrinolytic system in hypertensive renal injury, specifically the roles of plasminogen activator inhibitor-1 (PAI-1) and urokinase-type plasminogen activator (uPA)/urokinase receptor (uPAR). The study utilized a mouse model in which hypertension was induced by the infusion of angiotensin II (AngII) and aldosterone (Ald). There were five mice genotypes in the study: wildtype (WT), PAI-1 deficient (PAI-1/), uPA deficient (uPA/), urokinase receptor deficient (uPAR/), and uPA mutant ($uPA^{GFDhu/GFDhu}$) in which uPA's ability to bind to uPAR is impaired but its proteolytic activity is normal. The harvested mouse kidney specimens were fixed in 4% paraformaldehyde, embedded in paraffin, and cut into 4 μm sections. The amount of collagen deposition in the kidneys was assessed through picro-Sirius Red staining, and leukocyte and macrophage infiltration was assessed by immunohistochemical staining of kidney sections for common leukocyte antigen CD45 and monocyte chemoattractant protein 1 (MCP-1), respectively. Quantitative Real-Time Polymerase Chain Reaction (qRT-PCR) experiments were performed to evaluate the expression of genes associated with renal inflammation. The data indicate that hypertensive uPA/ mice had enhanced renal injury compared to hypertensive WT mice. Therefore, uPA has a beneficial effect in hypertensive mice. Research is ongoing to further characterize the mechanism through which uPA protects against hypertensive renal disease, particularly the effect of its interaction with uPAR on this process.

Poster Presentation

Fossil and Literature Analysis on the Cause of K-T Extinction

Simian Huang
College of Science
Biochemistry

Advisor: Ronald Hellenthal, Dept. of Biological Sciences

The fossil record documents a major extinction event, known as the "K-T Extinction" that occurred at the end of the Mesozoic Era, approximately 65-66 million years ago. It is thought to have resulted in the elimination of about three quarters of the Earth's plant and animal species, including the dinosaurs, marine reptiles, flying reptiles, and many groups of marine invertebrates. The "Alvarez Hypothesis," first proposed in 1980, attributed the mass extinction to an asteroid collision with the Earth, with the impact site located in the Yucatan Peninsula near Chicxulub, Mexico. There has been considerable discussion and debate about this explanation of the K-T Extinction and many alternative theories have been proposed. My research examined hypotheses of the cause of the K-T Extinction to provide an integrated summary of what may have led to the faunal turnover at the end of the Cretaceous period. This included a review and summary of the evidence, major conclusions, and weakness of these hypotheses. Fossils in Notre Dame's Museum of Biodiversity were used as evidence to substantiate or refute major theories. Overall, the asteroid impact theory has the most reliable evidence so far, while the volcano theory is constructed more on speculation. However, a more convincing interpretation is needed to explain the regional extinction disparities. In addition, researchers also should be aware of the limitations of what can be inferred from fossils records, considering the limited number of species that are preserved as fossils.

Poster Presentation

R-Process Nucleosynthesis in Simulations of Binary Neutron Star Systems

Zachary Huber
College of Arts & Letters
Physics and Program of Liberal Studies

Advisor: Rebecca Surman, Dept. of Physics

One key objective in the field of nuclear astrophysics is to explain the formation of the heaviest isotopes and their observed abundances in the solar system and galaxies. Rapid neutron capture (r-process) nucleosynthesis is a mechanism by which many of these isotopes may be formed in high energy astrophysical events such as supernovae or the collapse of binary neutron star systems. The aim of this project is to explore the effects that nuclear properties such as electron fraction, entropy, and the nuclear equation of state have on r-process nucleosynthesis that occurs during the collision of two neutron stars. Using simulation data of the collapse of binary neutron star systems of varying physical and nuclear properties from Just et al. (2015) as the starting point for our calculations, we extrapolated the temperature according to various microphysical equations of state in order to build output files compatible with the PRISM nucleosynthesis code which calculates the nuclear abundances. With these files, we then calculated several abundance patterns for individual trajectories within our data set.

Oral Presentation

Quantitative, model-based estimates of variability in the generation and serial intervals of *Plasmodium falciparum* malaria

John Huber
College of Science
Applied and Computational Mathematics and Statistics
Geoffrey Johnston, Apple
Bryan Greenhouse, Dept. of Medicine, University of California, San Francisco, CA
David Smith, Institute for Health Metrics and Evaluation, University of Washington, Seattle, WA
Alex Perkins, Dept. of Biological Sciences

Advisor: Alex Perkins, Dept. of Biological Sciences

The serial interval is a fundamentally important quantity in infectious disease epidemiology that has numerous applications, such as inferring transmission linkages between reported cases of Plasmodium falciparum malaria in near-elimination settings. Despite its importance, the serial interval for P. falciparum is poorly understood quantitatively. To obtain a quantitative estimate of its serial interval, the sum of the components of the P. falciparum transmission cycle was taken based on a combination of mathematical models and empirical data. During this process, a number of factors were identified that account for substantial variability in its serial interval across different contexts. The implications of this variability for inferences about transmission linkages between reported cases will be discussed.

Poster Presentation

Acamprosate Rescues Neuronal Defects in the *Drosophila* Model of Fragile X Syndrome

Russell Hutson
College of Science
Biological Sciences
Rachel Thompson
College of Science
Biological Sciences and French

Advisor: Charles Tessier, Indiana University School of Medicine, South Bend, IN

Acamprosate was originally approved by the FDA in 2004 for the maintenance of abstinence from alcohol use in adults. However, a number of recent studies have shown this medication to provide some clinical benefits in youth with Fragile X Syndrome (FXS), an autism spectrum disorder and the most common known cause of inherited intellectual disability. While promising, the mechanism by which the drug operates remains unknown. In this study, we used the *Drosophila* Fragile X Syndrome model, which is a genetic knockout of the highly conserved dFMR1 gene, to examine the impact of acamprosate on neuronal development. In the dfmr1 null animals, the larval neuromuscular junction (NMJ) is overgrown leading to hyperactive synaptic transmission. Acamprosate treatment rescues this excessive neuronal growth and furthermore reduces the number of active synapses at the NMJ. A larval behavioral assay also demonstrates that acamprosate at least partially rescues the uncoordinated movement present in dfmr1 null animals. These data strongly support the use of acamprosate to treat Fragile X Syndrome and potentially other neurodevelopmental disorders. Further analysis of the precise mode of action of this compound may therefore yield new targets of therapeutic intervention.

Poster Presentation

From Host Race to Species: Parallel Genome-wide Divergence Mirrors Ecological Differences

Katherine Inskeep
College of Science
Biochemistry and Spanish
Meredith Doellman, Dept. of Biological Sciences
Scott Egan, Dept. of Biological Sciences, Rice University, Houston, TX

Advisor: Jeffrey Feder, Dept. of Biological Sciences

By studying the selective forces that generate new species in nature, speciation research seeks to understand the processes that create biodiversity. The *Rhageletis pomonella* species complex is a classic example of sympatric speciation in which these selective pressures and their genetic underpinnings are well studied. Variation in the timing of emergence (eclosion) of adult flies between the apple- and hawthorn-infesting *R. pomonella* is significant and previous studies have identified single nucleotide polymorphisms (SNPs) associated with differences in eclosion time. *R. mendax*, a closely related species within this complex, displays greater differences in eclosion phenology with *R. pomonella* than that displayed between *R. pomonella* host races. Therefore, we hypothesized substantial overlap between loci related to eclosion timing and loci differing between *R. mendax* and *R. pomonella*. Additionally, because phenology of *R. mendax* host fruit varies little across latitudes, only minor genetic variation amongst *R. mendax* was expected across its geographic distribution. To investigate these hypotheses, restriction associated DNA libraries were prepared from *R. mendax* and *R. pomonella* genomic DNA extracts and sequenced using Illumina Hi-Seq. Trimmed reads were aligned to the *R. pomonella* draft genome and SNPs were called and filtered. This allowed for the assessment of inter-species genomic differentiation and intra-species population structure. Although *R. mendax* and *R. pomonella* displayed large allele frequency differences genome-wide, particularly among loci associated with eclosion timing, no fixed differences were identified, indicating that an ongoing low level of gene flow is likely occurring. As expected based on other genetic markers, *R. mendax*, unlike *R. pomonella* showed little genomic variation across its geographic range. Therefore, genetic variation associated with eclosion timing appears to contribute significantly to the divergence of *R. mendax* from *R. pomonella*, but does not likewise create diversity within *R. mendax*.

Poster Presentation

Cryopreserved Mammary Tissue from Transgenic Mouse Models of Breast Cancer Supports Organoid Branching and Cell Dissemination

Charley Jang
College of Science
Science Preprofessional Studies

Advisors: Laurie Littlepage and Christopher Suarez, Dept. of Chemistry and Biochemistry

Three-dimensional (3D) cultures have been invaluable for expanding our knowledge of tumor biology and cellular interactions. Primary tumor cell clusters, called organoids, grow and branch in culture and are an excellent model for tumor progression, invasion, and drug response. However, organoid preparation protocols typically require fresh tumor tissue samples, which limits research and clinical flexibility and usefulness. We have developed and validated a method for cryofreezing mammary gland tissue that is amenable to using in future organoid cultures. In this study, we look to validate a procedure for preparing organoids from cryopreserved tumor samples by investigating whether the process of cryopreserving tumor samples alters the cell dissemination and branching behavior of these organoids. Organoids of approximately 200-1000 adherent cells were prepared from fresh and cryopreserved tumor samples from transgenic mouse models (PyMT, Wnt-1, and C3-TAg) and grown in collagen I extracellular matrix (ECM), which is a major component of the ECM of mammary glands, to model the normal stromal ECM. The 3-D branching morphology and cell dissemination patterns of the organoids were compared between the fresh and cryopreserved tumor samples and among the different transgenic models. Organoid cultures from both the fresh and cryopreserved tumor samples were visualized by time-lapse microscopy for 2 days. Both branching morphologies and cell dissemination patterns were quantified at time points 0, 10, 20, 30, and 40 hours. Branching and cell dissemination patterns were similar between fresh and frozen tissue sources but varied between transgenic tumor models. The PyMT organoids generated from fresh and cryopreserved tumor samples consistently had the highest protrusive tip frequency when compared to the other transgenic tumor mouse models. The C3-TAg organoids were characterized by single branches, and the Wnt-1 organoids were characterized by rounded buds. Our results demonstrate that organoids can be grown from thawed cryopreserved tissue samples to faithfully recapitulate the organoid branching potential of the fresh tissue. In addition, we find that organoid cultures derived from tumors have branching and cell dissemination programs that are differentially induced by individual oncogenes.

Oral Presentation

Designing and Building Components for the ND-Cube Detector

Louis Jensen
College of Science
Physics

Advisor: Tan Ahn, Dept. of Physics

Nuclear experiments with radioactive beams are needed to improve our understanding of nuclear structure far from stability. Radioactive beams typically have low beam rates, but active-target detectors can compensate for these low beam rates and enable nuclear experiments that would otherwise be either impossible or unlikely. At the University of Notre Dame, we are developing our Active Target Time Projection Chamber detector, the ND-Cube, in order to perform these experiments. Designing and building such a detector, however, comes with many challenges. This detector includes many components such as a vacuum chamber, field cage, Micromegas circuit detectors, a system to precisely measure the drift velocity, and many more. For my project, I have assisted in building and designing of ND-Cube components, most especially the building of the field cage and the design for a system to precisely measure the drift velocity. With the development of the ND-Cube, our Nuclear Physics Lab here at the University of Notre Dame will be able to perform new and interesting nuclear physics experiments in the pursuit of understanding nuclear structures and how nuclear reactions relate to the origin of our universe.

Poster Presentation

Real-time investigation of the influence of shear pressure and compression on mitochondria in single disseminated tumor cells during mechanical arrest under PTEN regulation

Lan Jiang
College of Science
Biological Sciences
Wendy AlvarezBarrios, Dept. of Biological Sciences

Advisor: Siyuan Zhang, Dept. of Biological Sciences

Metastasis is the most commonly life-threatening stage in breast cancer, affecting millions of women in the United States. One of the most critical stages in metastasis is mechanical trapping; a crucial point when circulating tumor cells (CTCs) enter a vessel with diameter smaller than that of a tumor cell. At this point, CTCs become arrested because they physically cannot go through the blood vessel due to their size. At this stage of metastasis, tumor cells experience mechanical stress from their surrounding environment, including shear stress and spatial compression. Previously, mechanical stress has been shown to increase tumor cell motility under 2D conditions. Unfortunately, it remains largely unknown how mechanical stress affects tumor cells during physical trapping and how these physical forces influence their metastatic potential at this stage of the metastasis cascade. One of the main barriers in current research of physical arrest of CTCs comes in the limitations of the traditional 2D and 3D culture systems that are available to study tumor cell behavior. Cell behavior is largely dependent on the physical cues imposed by the microenvironment, such as the stress and compression forces encountered during physical trapping. However, in neither 2D nor 3D culture systems, shear pressure and mechanical compression can be applied to the tumor cells simultaneously, which renders these cell culture systems ineffective for the study of CTCs during physical arrest. To overcome these limitations, our lab designed and established a microfluidic device as an alternative model system to reconstruct both mechanical stress and spatial constraint experienced by tumor cells during physical arrest. To gain more insights on how mechanical stress may affect on tumor cells viability and bioenergetics during physical arrest, subcellular localization and activities of mitochondria are studied in the live tumor cells during physical trapping. Using microfluidic device to study cancer cell bioenergetics change during physical trapping could provide new insights in studying cancer cell behaviors during physical arrest.

Poster Presentation

How Does Weather Affect Bacteria, Macroinvertebrates, and Natural Water Qualities?

Grace Jones
New Prairie Middle School

The purpose of my project is to examine three natural sources of water and how weather affects the quality of those environments for aquatic life development. The purpose for testing both macroinvertebrates and bacteria along with phosphorus and nitrates is not only to get a chemical makeup of the water, but a living picture. Monitoring natural water sources will help to protect them for future generations by providing clean water sources. My experiment shows a correlation between aquatic life and chemicals introduced and those changes due to weather. Macroinvertebrates feed on bacteria, which bacteria can come from there different sources: manmade, animals, and natural decay. If people neglect our natural water sources, it will impact the quality of life necessary for all living things to survive. Therefore, we should all do our part to conserve and protect the natural water sources and the overall environment for future generations.

Poster Presentation

Determining the effect of stellar evolution on carbon abundances

David Kalamarides
College of Science
Physics

Advisor: Vinicius Placco, Dept. of Physics

Carbon-Enhanced Metal-Poor (CEMP) stars are believed to be the direct descendants of the first generation of stars to be formed in the universe. Detailed chemical abundances of CEMP stars are important inputs for theoretical models, and the effects of stellar evolution on some of these abundances must be accounted for. Since the carbon content of these stars can decline as they age, it is necessary to correct observed measurements back to the initial conditions. We have refined the procedure for which we estimate corrections for carbon abundance ratios ([C/Fe]) from a large sample of observed stars from the Sloan Digital Sky Survey. After adjusting the models to match the observed data, new estimations were made from a Locally Weighted Scatterplot Smoothing (LOESS) regression function, which estimates [C/Fe] from a number of other parameters that are easier to identify in stars, such as surface gravity, effective temperature, and metallicity. The results so far indicate that this method may have far greater accuracy then the previous approach.

Oral Presentation

Interest Rates: Models and Applications

Sean Kent
College of Science
Mathematics

Advisors: Thomas Cosimano, Dept. of Finance and Alex Himonas, Dept. of Mathematics

In many finance classes, from beginning to advanced levels, the interest rate used to evaluate the time value of money is often taken as a given. Moreover, it is assumed to be constant over a given time period, which is rarely the case. The purpose of this paper will be to offer a self-contained survey of a variety of mathematical models for the interest rate. In addition to an examination of the solution for each model, it will be examined for its value as an estimation for the real or future interest rates. Further, the paper will explain the features of each model, particularly as they apply to the features we expect in the interest rate. One model that will be explored is the overlapping generation model for determining interest rates, originally developed by Paul Samuelson in 1958. This model will provide an idea for how the interest rate should move, but will not be very practical for calculations. Another popular model explored is the Vasicek model, developed in 1977. This one assumes that the interest rate is given by a stochastic process, thus requiring more advanced mathematics like Ito's Lemma and Partial Differential Equations to give a closed form solution for a given interest rate. The Vasicek model will allow a closed form calculation of bond prices. A few expansions of these models will also be examined.

Poster Presentation

Halide Exchange in Perovskites For Solar Cells

Elisabeth Kerns
College of Science
Chemistry Business

Advisors: Subila Kurukkal Balakrishnan and Prashant Kamat, Dept. of Chemistry and Biochemistry

The anion exchange in cesium lead bromide (CsPbBr3) nanocrystals were performed using different ligands and the change in photophysical properties were studied using different spectroscopic methods. Perovskites are semiconductor materials, which show a very high efficiency of 20% in solar cell. The perovskite structure is very flexible, participating in both anionic and cationic exchange, giving different properties. The band gap can be easily tuned over the entire visible spectra by controlling the composition of halide anions. Usually, a fixed ratio of two different halide precursors are used in order to make mixed perovskites. Here in, we employed a post synthetic anion exchange by using different organic ligands (surfactants) having halides and forms mixed perovskites of definite band gap. The excited state properties of mixed halide perovskite have been studied using time correlated single photon counting spectrometer (TCSPC). The excited state lifetime varies upon anion exchange.

Poster Presentation

Parasite Burden on Wild Amboseli Baboon Survival

Joohye Kim
College of Science
Biological Sciences and Sociology

Advisor: Elizabeth Archie, Dept. of Biological Sciences

Parasites are known to be harmful to mammalian hosts, but studies that demonstrate these costs in wild mammal populations are scarce. Further, we do not understand how these costs vary for different parasite species or parasite burdens. Here we test the hypothesis that parasites limit host survival in the well-studied wild baboon population in Amboseli, Kenya. Specifically, we will test the hypothesis that inter-individual differences in parasite burdens predict host survival. The hypothesis will be supported if baboons with high parasite loads die earlier than baboons with low parasite burdens. In order to test the hypothesis, long-term data on the baboons' parasite loads will be collected and organized. We will use common parasitological techniques like fecal float and sediment to obtain parasite counts on new samples from the baboons. By understanding how parasites loads and specific parasites affect survival of the Amboseli baboons, there will be a better understanding of the relationship between the parasites and baboons, and how the increased load affects survival.

Poster Presentation

Capacitors - How much energy can a Leyden jar store?

Cole Klinedinst
Discovery Middle School

The reason that I would like to conduct this experiment is to build a Leyden jar, which is a type of old fashioned capacitor, and see how much energy it can store. To build the electrophorus, tape the Styrofoam cup to the center of the aluminum pie tin. To build the Leyden Jar, fill the film canister 80% full with water then hammer a nail through the lid of the canister. Wrap the outside with aluminum foil and secure it with tape. To charge the electrophorus, rub the acrylic with wool. Touching only the Styrofoam cup, place the electrophorus on the acrylic. Then, touch the edge of the pie tin. To charge the Leyden Jar, pick up the tin holding only the cup and touch it to the nail. Repeat steps 3 and 4 for the proper charging cycles. To discharge the jar, tape one end of the wire to the aluminum sheet in the Styrofoam block and the other end to the aluminum foil covering the Leyden jar. Place the jar in a plastic soap dish and slowly slide the dish toward the aluminum sheet until there is a spark. To determine the voltage, measure the distance from the nail head to the aluminum sheet and record. Use the formula, 1 cm spark =30,000 volts at 1 atmosphere to determine the voltage. The average spark distance after 1 cycle was 0.1 cm. The average spark distance after 5 cycles was 0.433 cm. The average spark distance after 10 cycles was 0.5 cm. In conclusion, my hypothesis was partially right. I was right about how as the number of charge cycles increase, the voltage would go up and then plateau. However, I overestimated the charging capacity of the Leyden jar. The jar became full much faster than I thought. I originally thought that there would be a 20% increase from 1 to 5 charging cycles and a 50% increase from 5 to 10 cycles. In actuality, from 1 to 5 cycles there was a 333% increase and from 5 to 10 there was a 13.4% increase.

Poster Presentation

Role of Leishmania protein phosphatase 5 in stress response and pathobiology

Joseph Krivda
College of Science
Biological Sciences
Miguel Morales and Brianna Norris, Dept. of Biological Sciences

Advisor: Miguel Morales, Dept. of Biological Sciences

Leishmania parasites are responsible for important neglected diseases in humans and animals, ranging from self-healing cutaneous lesions to fatal visceral manifestations. During the infectious cycle, Leishmania differentiates from the extracellular, flagellated promastigote, found in sandflies, to the intracellular, pathogenic amastigote present in mammalian hosts. Parasite differentiation is triggered by changes in environmental cues, primarily pH and temperature. In general, extracellular signals are translated into stage-specific gene expression through a cascade of reversible protein phosphorylation that is regulated by protein kinases and phosphatases. Though protein kinases have been actively studied, our understanding of the biology of protein phosphatases in Leishmania is poor despite their implication in critical post-translational modifications and differentiation. Here, we report the principal analysis of a novel protein phosphatase 5 (PP5) in Leishmania species. To begin, we used in silico analysis to interrogate the Leishmania major genome for PP5. To biochemically characterize PP5, we generated a recombinant protein and measured its catalytic activity. A polyclonal anti-PP5 antibody was raised and PP5 expression levels across different parasite life cycle stages were examined using western blotting. PP5 null mutant parasites were generated using the negative selection system. From this, we determined PP5 to be a feasible potential drug target based on its low similarity with mammalian counterparts. Recombinant PP5 proved it to be a bona fide phosphatase that is enzymatically active and site-directed mutagenesis confirmed auto-inhibitory roles of the N-terminal region. PP5 is developmentally regulated, with increased expression in metacyclic promastigotes, suggesting a possible role in metacyclogenesis. The generation of PP5 null mutant parasites is currently shedding light on the role of PP5 in the pathobiology of the parasite. Collectively these data support further exploration of PP5 to determine its potential future applicability for anti-parasitic intervention.

Poster Presentation

Asbestos related pleural disease in insulator workers

Norbert Kuc
College of Science
Biological Sciences
Daniel Currie
College of Engineering
Computer Engineering

Advisor: Eric Hart, Northwestern Medical Group, Chicago, IL

Asbestos exposure leads to several thoracic diseases, including mesothelioma, pleural disease, and lung cancer. Workplace regulations in the 1970s aimed to reduce occupational asbestos exposure. This study is targeted at examining the prevalence of pleural abnormalities in insulator workers to discover the effectiveness of these regulations and the extent to which low level exposure causes pleural abnormalities. In this IRB-approved retrospective study, data was taken from Low-Dose Computed Tomography (LDCT) lung cancer screenings of 245 Local 17 union members with initial workplace exposure dates ranging from the 1950s to the 1990s. Based on the presence, laterality, location, and appearance of pleural abnormalities, patients were diagnosed with non-asbestos related pleural disease, pleural disease suggestive of asbestos exposure, or asbestos related pleural disease. A 5-point Likert scale (0-4) was used determine disease severity. Among the 98 Local 17 members screened for pleural disease who were initially exposed to asbestos in the 1980s or later, 54 (55%) exhibited symptoms indicative of asbestos related pleural disease, whereas 44 (45%) showed no markers of pleural disease. On a 0-4 scale with 4 being extensive and 0 being none, the average disease severity was a 1. These results indicate continued low level occupational exposure, despite the regulations introduced in the 1970s. Screenings at other chapters could reveal whether asbestos exposure is unique to workers in the Chicago area. The implementation of preventative screenings may mitigate the risk of developing malignant asbestos related disease, and additional workplace evaluations may further limit this substantial threat to insulator worker health.

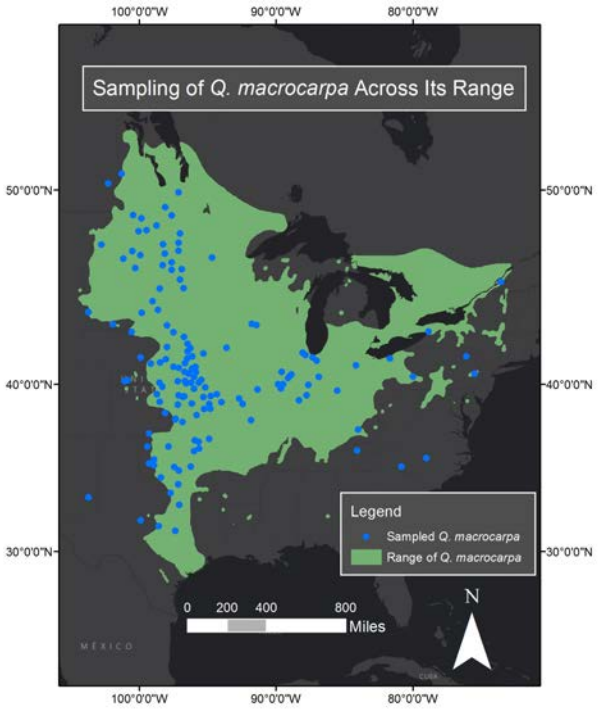
Poster Presentation

Genetic Diversity and Structure of Bur Oak (*Quercus macrocarpa*) Across Its Range

William Langbo
College of Science
Biological Sciences and Theology
Warren Chatwin
College of Science
Biological Sciences

Advisor: Jeanne Romero-Severson, Dept. of Biological Sciences

Bur Oak (*Quercus macrocarpa*) is a large economically important hardwood tree found in eastern and central North America. Anthropogenic influences have affected the native range and distribution of this species. Few studies have been conducted on this species, and the most recent range-wide study was conducted with a limited geographic sampling using allozymes in 1990. Improved techniques for assessing genetic diversity present a need for reassessment of genotypic variance across the range of *Q. macrocarpa*. Our objective is to assess genetic diversity of *Q. macrocarpa* across its geographic range in order to obtain a better understanding of its genotypic variation. Understanding the genetic diversity and differentiation of *Q. macrocarpa* will reveal geographic population substructure and provide guidance for forest management. We hypothesize that *Q. macrocarpa* will show high levels of genetic diversity among individuals with low levels of genetic differentiation across its range. In 2015, we collected 506 samples, representing the geographic range of *Q. macrocarpa*, from four provenance plots and extracted DNA from each of these samples. In spring 2017, we employed a targeted sequencing technique to selectively capture ~500 EST-SSR microsatellite sequences from a screening panel of 11 *Q. macrocarpa* samples representing its entire geographic range. These samples were sequenced on an Illumina NextSeq at the Notre Dame Genomics Core Facility and processed using multiple bioinformatics programs. We will select the 16 most informative EST-SSR sequences which will be used to genotype all 506 samples. The data will be analyzed using the Bayesian analysis program STRUCTURE to assess the population substructure of *Q. macrocarpa*. For future studies, we will use climate data (www.worldclim.org) to identify possible relationships between genotype and specific climate variables. This relationship will be useful in informing predictive models of range shifts of *Q. macrocarpa* under climate change.



Poster Presentation

Further Applications of Dielectric Constants in Water

Andrew Latham
College of Science
Applied and Computational Mathematics and Statistics and Chemistry

Advisor: Daniel Gezelter, Dept. of Chemistry and Biochemistry

Computational methods attempt to balance accuracy and computational efficiency. Modern theory in molecular dynamics and coarse-grained models reduce computation time through the use of implicit solvents. Implicit solvent models use functions to approximate how molecules interact in solvent without explicit solvent molecules present. These models include a dielectric constant that damps interactions between ions to account for the solvent. Our work calculates the dielectric constant in water as a function of distance using the potential of mean force. This procedure involves calculating the constraint force required to keep the ions at a fixed distance. Unlike previous dielectric models, our model captures the stabilization of ions at close distances due to the reorientation of water molecules and accounts for effects created by solvation shells.

Oral Presentation

Effect of a Topical Repellent on Dengue Vector Behaviors

Jugyeong Lee
College of Science
Science Business and Studio Art and Design

Advisor: Nicole Achee, Dept. of Biological Sciences

Dengue fever is an incurable tropical human disease, caused by the dengue virus of which there are five serotypes (DENV1-5) transmitted by the mosquito *Aedes aegypti*. Almost half of the world, an estimated 390 million people, is at risk for dengue fever. A vaccine, Dengvaxia (CYD-TDV), has been developed but its level of efficacy varies depending on the serotype and other factors, therefore the World Health Organization has not recommended broad implementation. The primary strategy for dengue prevention is through vector control, such as breeding site management and personal protection products, including repellents. N,N-diethyl-m-methylbenzamide (DEET) is an active ingredient widely used in topical repellent products but in 2005, the Centers for Disease Control approved para-Menthane-3,8-diol (PMD), derived from the Australian lemon eucalyptus plant, for human use. Although PMD is less prevalent than DEET, studies have indicated similar efficacy, demonstrating 90-95% mosquito bite reduction (repellency). In addition to repellency, DEET can reduce mosquito feeding behavior post-exposure; a phenomenon that other actives have been shown to elicit. To fully characterize the impact of PMD, the current study explored affects of PMD exposure on female *Ae. aegypti* blood-feeding and egg production. Mosquito test cohorts were exposed to either 20% PMD or ethanol solvent alone (control) for 10 min, blood-fed for 30 minutes, knocked down and weighed to quantify the blood meal. In the second phase, additional cohorts were exposed in the same manner, allowed to lay eggs, and killed for egg counting. Results showed a statistically significant reduction ($p<0.001$) in the number of *Ae. aegypti* that blood-fed when exposed (38%) compared to non-exposed cohorts (49%). However, there was no significant difference in fecundity indicating that PMD does not effect egg production. The repellent effect of PMD to prevent *Ae. aegypti* biting, in combination with a reduction in feeding by those mosquitoes that are not repelled but exposed to PMD, suggests PMD products may offer both personal and community protection against dengue fever as reduced feeding lowers the probability of infective mosquitoes available to transmit DENV. Further studies are warranted to investigate the effect of PMD exposure on mating and survival of adult mosquitoes.

Poster Presentation

Quantification of plasminogen activation system proteins PLAU, SERPINE2, and SPINT2 in aggressive OVCAR5 and OVCAR8 cell line derivatives

Eric Lee
College of Science
Science Business
Sharon Stack, Harper Cancer Research Institute and Dept. of Chemistry and Biochemistry
Siyuan Zhang and Chunyan Li, Dept. of Biological Sciences
Jing Yang, Dept. of Chemistry and Biochemistry
Xuejuan Tan, Dept. of Biological Sciences
Zonggao Shi and Yueying Liu, Dept. of Chemistry and Biochemistry
Kelly Volk
College of Science
Biochemistry
Anne Grisoli
College of Science
Neuroscience and Behavior

Advisor: Yueying Liu, Dept. of Chemistry and Biochemistry

To determine the transcriptomic profile of epithelial ovarian cancer cells, OVCAR5 and OVCAR8 cells were injected intraperitoneally (IP) into nude mice to establish two aggressive cancer cell sublines. To assess the genomic changes that occurred between the parental cell lines and the IP-injection-derived cells ("IP cells"), four sample cohorts were collected: OVCAR5, OVCAR8, and their respective IP cells. Expression of select genes in the IP cells was predicted using HTSeq and compared to the corresponding expression in parental cells. Three serine proteinase genes, PLAU, SERPINE2, and SPINT2, showed significant changes in predicted gene expression and were selected for analysis. Elevated expression of PLAU has been correlated with tumor malignancy and is hypothesized to promote tumor cell invasion. High SERPINE2 mRNA expression is found in gastric cancer tissues. Finally, SPINT2 is suggested to be overexpressed in pancreatic cancer cells. Genomic expression of PLAU, SERPINE2, and SPINT2 in parental and IP cell lines was quantified using qPCR. Analysis of gene expression in sample triplicates using StepOne Software indicated higher relative expression of PLAU and SPINT2 in OVCAR5 IP and OVCAR8 IP cell lines compared to parental cells. OVCAR5 IP cells showed lower expression of SERPINE2 compared to parental cells. However, the difference in SERPINE2 expression in OVCAT8 IP cells compared to parental cells is currently inconclusive, and further analysis must be done. Preliminary quantification of PLAU activity using a plasminogen activation assay indicated increased uPA activity in IP cells, confirming the predicted and measured increase in PLAU gene expression. Ongoing protein quantification of SERPINE2 and SPINT2 using immunohistochemistry will be analyzed with Aperio ScanScope-associated macros. These data will establish some of the transcriptomic changes that may contribute to the increased metastatic capacity of the IP cell sublines, and potentially clarify the role that plasminogen-activating proteins play in facilitating cancer cell metastasis.

Poster Presentation

Electron Studies for the Proposed CMS L1 Track Trigger Upgrade

Tanner Leighton
College of Science
Physics

Advisors: Michael Hildreth and Kevin Lannon, Dept. of Physics

The Large Hadron Collider (LHC) at CERN in Geneva, Switzerland will be upgraded in the mid-2020s to produce events at higher instantaneous luminosities, and therefore the Compact Muon Solenoid (CMS) detector will require an upgrade in order to handle the accompanying increase in collision events. This upgrade involves implementing a system capable of reconstructing charged particle tracks from the detector in real time using field-programmable gate array (FPGA) technology, known as a Level-1 (L1) Track Trigger. In order to study the expected performance of the trigger system, an FPGA emulation code has been developed which is capable of running over simulated events corresponding to the anticipated output of the upgraded LHC. This research focuses on the implementation of realistic limits in the code and the study of more complicated electron events in order to prepare for the upgrades to the CMS detector and the LHC. Our overarching goal is to reconstruct electron tracks so that an acceptable efficiency for electrons can be achieved. Our first idea is to try to use wider windows (i.e., a bigger range of locations per layer) when searching for stubs that match the tracks. This approach is not without risk. The wider windows might result in finding more spurious tracks due to associating random stubs that don't come from a common track. For the presentation, we will have plots to show that quantify the efficiency and performance of the current track trigger algorithm. Optimistically, we will also be able to provide insight into how to best improve the algorithm through adjusting window sizes appropriately.

Poster Presentation

Optimizing MicroMegas Design for Nuclear Experiments

Joseph Levano
College of Science
Physics
Samuel Henderson, Dept. of Physics

Advisor: Tan Ahn, Dept. of Physics

Clustering in nuclei is a critical piece of the puzzle that is the production of elements in stars. We are working to find resonant states in nuclei that have cluster structure which allow for the production of higher mass nuclei. I will design a prototype of a device called a MicroMEsh GAseous Structure (MicroMegas) which will be used as a detector component in experiments helping to find these resonant states. The MicroMegas will detect electrons produced in our experiments by charged-particles. By detecting these electrons, we can image the tracks made by these charged particles. This can tell us about the probability of a certain reaction taking place due to a resonant state. In my designs of a Micromegas, I seek to optimize the detector electrodes, called pads, shape and placement to gather the data most sensitive to track positions. The MicroMegas will be an important component of a larger instrument that will be used for experiments to determine the process of element synthesis.

Poster Presentation

Validation of APC-knockdown gene expression profiles

Emily Leyden
College of Science
Biological Sciences
Jennifer Cole and Anne Arnason
College of Science
Science Preprofessional Studies
Jenifer Prosperi, Indiana University School of Medicine – South Bend, Harper Cancer Research Institute, and Dept. of Biological Sciences

Advisor: Jenifer Prosperi, Indiana University School of Medicine – South Bend, Harper Cancer Research Institute, and Dept. of Biological Sciences

Breast cancer is the most commonly diagnosed cancer in women in the United States, with over 250,000 new cases each year. In aggressive breast cancers, cells become resistant to multiple chemotherapeutic agents through changes in signaling pathways. The Adenomatous Polyposis Coli (APC) tumor suppressor gene is mutated or silenced by hypermethylation in up to 70% of sporadic breast cancers, causing changes to a variety of cellular processes. The Prosperi lab generated APC knockdown human breast cancer cells using the MDA-MB-157 cell line derived from a human metaplastic breast cancer. To understand how gene expression is impacted downstream of APC loss, we performed transcriptome analysis using RNA-sequencing. Sixteen genes were selected as potential targets of APC loss when comparing gene expression profiles with the parental cells. In addition, we have performed data-mining in The Cancer Genome Atlas (TCGA) database to determine gene expression that correlates with APC. Real time PCR confirmed decreased expression levels of CYB5R2, ADAMTSL1, ZNF366, and CXCR7 in the knockdown constructs, corresponding to the RNA sequencing data and TCGA mining. Current studies in the laboratory are focused on protein validation of target genes. Future studies will aim to restore gene expression in the APC knockout cell lines and assess the impact on tumorigenic properties. Given that APC loss resulted in resistance to chemotherapy, additional studies will be done using the knockdown constructs and parent 157 cells treated with paclitaxel and cisplatin to understand how chemotherapeutic drugs affect gene expression. These studies will enhance our understanding of chemotherapeutic resistance and may ultimately lead to more effective treatments for APC-mutant breast cancers.

Poster Presentation

GPCR Targeted Insecticide Design for Control of Vector Mosquitoes Transmitting Dengue and Zika

Zoe Loh
College of Science
Biochemistry

Advisors: Mary Ann McDowell and Douglas Shoue, Dept. of Biological Sciences

Zika and Dengue are infectious diseases that are caused by the vector mosquito *Aedes aegypti*. The spread of the diseases has increased the need for containment and eradication. Past development of insecticide drugs, including permethrin and DDT are starting to become unsatisfactory due to the increased resistance of disease carrying vectors. New techniques of vector control and disease prevention look to G Protein Coupled Receptors (GPCR's) as insecticide targets. GPCRs play a huge role in transducing extracellular stimuli into intracellular stimuli that are part of signaling pathways affecting many physiological events in mosquitoes. GPCRs respond to ligands that are easily manipulated, essentially "easily druggable", meaning that it is easy to develop compounds that can affect the receptors. Octopamine receptors is one of the identified GPCRs that bind to octopamine which is a neuromodulator involved in multiple cellular pathways. A growing number of studies have suggested that octopamine plays a prominent role in modulating physiological and behavioral processes in invertebrates. The octopamine receptor appears to not be present in vertebrates, which could mean that they present as a suitable insecticide target. Amitraz is a current effective acarid pesticide that targets octopamine receptors and was thought to have the same effect on mosquitoes. This was not observed after experimentation with adult *Aedes aegypti*, but the octopamine receptor that the insecticide targeted was still a basis for further research. Compounds, like formamide insecticides, LG-8, related to Amitraz could serve as ligands that can act as an agonist for octopamine receptors. Formamide insecticides act as an agonist for octopamine receptors, activating the receptor better than octopamine itself. To determine the effect of LG-8 on mortality we conducted a variation of the WHO susceptibility test. The ability of LG-8 to kill in a dose dependent manner shows the need for further investigation of the compound and its potential use as a new insecticide on the market. Future studies will continue to focus on LG-8 and modifying it to optimize its effectiveness while minimizing its toxicity to humans and the environment.

Poster Presentation

Compression-Induced Cadherin Shifts in Ovarian Cancer Multicellular Aggregates

Rachel Lombard
College of Science
Science Business
Yuliya Klymenko and Holly Weiss-Bilka, Dept. of Biological Sciences
Leigh Campbell
College of Science
Science Preprofessional Studies
Matthew Ravosa, Dept. of Biological Sciences

Advisor: Sharon Stack, Harper Cancer Research Institute and Dept. of Chemistry and Biochemistry

Ovarian cancer is clinically accompanied by excessive accumulation of intraperitoneal malignant ascites (up to 5 liters) relatively early in the disease. In addition to chemical cues, ascitic fluid buildup may also alter the force environment in the peritoneal cavity, thereby impacting the original ovarian tumor, metastatic cells and multi-cellular aggregates (MCAs), and host peritoneal tissues. The potential effect of ascites-induced changes in peritoneal mechanobiology on tumor cells and host structures has not been investigated due to lack of appropriate model systems. In this work, we present a novel method of applying a patho-physiologically relevant pressure (~22-24 mmHg) to ovarian cancer MCAs using a Flexcell-400C Compression system and Biopress+ plates. To ensure even loading conditions, molds were designed to enable production of porous hydrogels containing defined void areas so as to encapsulate MCAs within the hydrogel carrier. Hydrogel-encapsulated MCAs are then placed into the sample well wherein they more uniformly encounter the Flexcell compression platen. Utilizing this approach, we investigated the potential effects of ovarian cancer MCA compression on gene expression associated with the epithelial-to-mesenchymal transition (EMT). Our preliminary data indicate that short-term static compression (6 hours) of ovarian cancer MCAs leads to downregulation of *CDH2* (N-cadherin, Ncad) gene expression alongside varying inhibition of E-cadherin (Ecad) suppressors *SNAI1*, *SNAI2* and *TWIST,* and EMT- promoters *MMP9, MMP14, EGF, WNT5A, ROR1* and *ROR2*. Alternatively, prolonged compression (24 hours) results in increased expression of Ncad and other EMT-supporting genes. Subsequent analysis of cadherin protein expression revealed the opposite trend; in particular, Ncad protein levels were elevated after short compression and reduced after long-term stress, while Ecad expression was variable. These findings suggest a complex response to microenvironmental mechanical cues. A comprehensive analysis of complete EMT gene signature, epigenetic changes, posttranslational modifications and microRNAs will provide additional insight into pressure-induced cadherin switching in ovarian carcinoma.

Poster Presentation

Total Mercury Concentrations and Isotopic Niche Overlap in Lake Michigan Prey Fish

Lea Lovin
College of Science
Biological Sciences
Whitney Conard and Brandon Gerig, Dept. of Biological Sciences

Advisor: Gary Lamberti, Dept. of Biological Sciences

Mercury (Hg) is a toxic, bioaccumulative metal commonly found in the environment. Due to multiple waves of invasive species in Lake Michigan, food webs and Hg bioavailability have been altered. Knowledge of bioaccumulation pathways in Great Lakes fish is limited, especially in prey fish, which are conduits for Hg biomagnification in larger sport fish. We investigated factors influencing total mercury (THg) concentrations in six common Lake Michigan prey fish species. Species assessed were from the 2015 USGS Lake Michigan trawl survey – Deepwater Sculpin (*Myoxocephalus thompsoni*), Slimy Sculpin (*Cottus cognatus*), Bloater (*Coregonus hoyi*), Alewife (*Alosa pseudoharengus*), Rainbow Smelt (*Osmerus mordax*), and Round Goby (*Neogobius melanostomus*). We measured individual fish attributes including length, weight, body condition, depth of capture, and capture location. Prey fish THg was measured using a Direct Mercury Analyzer (DMA-80) and stable isotope ratios (δ15N and δ13C) were determined using an Isotope Ratio Mass Spectrometer (Delta-Plus IRMS). Among species, Bloater contained the highest mean THg concentration (97.2 ng/g wet weight), and Rainbow Smelt had the lowest (6.9 ng/g wet weight). THg was positively related to fish length, but the magnitude of the effect varied by species. The highest THg accumulation per unit length was observed in Round Goby followed by Alewife and Deepwater Sculpin. Isotopic niche overlaps were observed between Bloater, Deepwater Sculpin, and Alewife likely due to similar prey sources, but these species had little overlap with Round Goby. THg was positively correlated with δ15N ($r = 0.65$) but not significantly correlated with δ13C ($r = -0.23$). These findings suggest that food web structure, fish size, and species identity all affect prey fish THg concentration. Knowledge of prey species' THg accumulation patterns can help reveal pathways of Hg bioaccumulation in sport fish that humans consume.

Poster Presentation

Examination of the Synergistic Growth Inhibition of 3-acetyl-11-keto-B Boswellic Acid (AKBA) and Curcumin on HT-29 Colorectal Cancer Cells

Yanting Luo
College of Science
Biological Sciences
Anthony Smyth
College of Science
Science Business
Michael Sokolowski
College of Science
Biological Sciences
Darius Yohannan
College of Science
Chemistry
Sarah Maazouz
College of Science
Chemistry

Advisors: Gabrielle Davis, Dept. of Biological Sciences
and Susan Gursky, Dept. of Preprofessional Studies

Chemotherapy has been a common means to combat colorectal cancer, despite its negative side effects. Recently, a branch of cancer research has been dedicated to natural phytochemicals such as curcumin and boswellic acid because they inhibit cancer and reduce the need for chemotherapy that leads to side effects including chemo brain, weight loss and infertility. Previous studies have demonstrated that both compounds are efficient at killing cancer cells in micro-molar ranges, while leaving normal proliferating cells unharmed. To date, no studies have looked at the combined effects of both drugs on cell proliferation. Curcumin, although very effective in cell culture, suffers from poor bioavailability *in vivo*. A combination of drugs that lowers the concentration needed for efficacy would aid in bringing this compound to clinical use. Curcumin acts by inhibiting several pathways, including the NF-kB and Cox2 inflammatory pathways, while boswellic acid modulates tumor suppressor miRNAs, working at both the G2/M and mitotic checkpoints. Due to these different modes of action, we hypothesize that together, curcumin and boswellic acid will act synergistically to kill tumor cells, and require a smaller concentration to achieve effective killing. HT-29 human colorectal cancer cells were treated with curcumin and 3-acetyl-11-keto-B Boswellic Acid (AKBA), both separately and combined. We used the MTT proliferation assay to monitor cell proliferation, and a one-way ANOVA with a Tukey back test along with the Loewe mathematical model to differentiate between additive and synergistic effects. Additionally, we used MCF-10A, an immortalized normal human mammary epithelial cell line, as a control for potential side effects of curcumin and AKBA treatment on non-cancerous cells.

Oral Presentation

One-Dimensional Dynamics & Milnor-Thurston Kneading Theory

Jeff Marino
College of Science
Mathematics

Advisor: Jeff Diller, Dept. of Mathematics

In the study of dynamical systems, we concern ourselves not only with the behavior of maps on a topological space, but also the behavior of a map's iterates. Two such maps exhibit the same dynamics if they are topologically conjugate, i.e., if there is some order-preserving homeomorphism that "changes the coordinates" of our space and allows us to examine the iterates of one map in lieu of those of the other. In this talk, I'll follow in the footsteps of Milnor and Thurston (1988) and highlight several combinatorial techniques that help us to better understand the dynamics of maps on the unit interval. Specifically, I'll introduce and manipulate the kneading invariant of a function in order to demonstrate that unimodal maps with positive topological entropy are semi-conjugate to piecewise linear "tent" functions, the dynamics of which are more readily apparent.

Oral Presentation

Markov Chains and Applications

Michael McCaffrey
College of Science
Mathematics

Advisor: Liviu Nicolaescu, Dept. of Mathematics

A Markov chain is a stochastic dynamical process with the property that its future behavior is determined only by its present state. The Markov chains have a huge number of applications and I will describe a few of them: card shuffling, cryptography, and sampling large networks.

Poster Presentation

Preparing for Isotope Harvesting at FRIB

Walter McLallen
College of Science
Physics
Patrick McGuire
College of Science
Physics

Advisor: Graham Peaslee, Dept. of Physics

Vanadium-48 (^{48}V) is a radioisotope that could be used for PET imaging. ^{48}V is being investigated as an additional PET isotope to be used in the arsenal of cancer treatments because of its shorter half-life and its ability to bind to certain cancer-treatment chemicals. Its radioactivity allows for higher counts within shorter time scales, resulting in higher resolution images. In order for ^{48}V to become a viable PET isotope, it needs to be efficiently produced in sufficient quantities. One potential source for this long-lived isotope is the Facility for Rare Isotope Beams (FRIB), under construction at Michigan State University. To determine whether this isotope could be extract from a mixture of isotopes produced in this future accelerator, researchers bombarded a water cell and graphite pucks with a ^{48}V beam from the current National Superconducting Cyclotron Laboratory at Michigan State University. A series of three detectors were used to monitor the decay of the samples over the course of several weeks. The analysis of the gamma-ray emission rates as a function of gamma-ray energy and time allows the total quantity of ^{48}V delivered on target to be determined. Initial experimental data suggest 48V is present and its decay can be tracked with time. Using the decay rate and number of counts for a given peak, an initial quantity delivered to target can be determined.

Poster Presentation

Construction of an Ion Beam Analysis Facility at Notre Dame

Walter McLallen
College of Science
Physics
Judah VanZandt
College of Science
Physics
Patrick McGuire
College of Science
Physics
Christian Femrite
College of Engineering
Computer Engineering
Connor Bagwell
Mendoza College of Business
Physics

Advisor: Graham Peaslee, Dept. of Physics

The Saint Andre Tandem Accelerator at Notre Dame for Applied Research and Development (STANDARD) is currently under construction in the Nuclear Science Laboratory. It is scheduled to be completed during the summer of 2017. Saint Andre is a 3 MV pelletron accelerator that will be used to perform ion beam analyses, specifically Particle Induced X-ray Emission (PIXE) and Particle Induced Gamma-ray Emission (PIGE) and Rutherford BackScattering (RBS). After exciting a target with a light-ion beam (H+ or He2+), these methods of analysis determine the elemental make-up of the material from the emitted x-ray or gamma ray wavelengths, or from scattered particle energies. These applied nuclear physics experiments are used for heavy element analysis such as those studies involving composition of tattoo inks and cosmetics that might contain toxic heavy metals, as well as the presence of lead paint in the South Bend community. The PIGE analysis can be used for analyzing lighter elements, including fluorine detection in water and consumer products. This elemental analysis can be used to screen for Per- and Polyfluorinated Alkyl Substances, which are a class of chemicals of concern in the environment.

Poster Presentation

The Cost of Electricity due to Deaths at Hospitals with Unreliable Energy Systems

Brady McLaughlin
College of Science
Physics in Medicine

Advisor: Abigail Mechtenberg, Dept. of Physics

In the developing world, power outages add another constraint to healthcare facilities seeking to deliver quality healthcare that are already strapped for resources. The results of capacity shortages can range from postponing accurate diagnosis, due to failure of diagnostic equipment like x-rays, to more directly deadly results, due to failures of life-saving equipment such as ventilators. While analysis of such capacity shortages is abundant for regions throughout the developing world, there is, to the knowledge of these authors, currently no analysis that connects capacity shortages to effects on human life. Since what policy makers and health officials alike use as a metric for determining which policies and programs will be effective is morbidity and mortality, elucidating this link between power outages and the direct burden on patients is necessary to demonstrate that policies to minimize power shortages are necessary. We do this by modeling current data and adding in value of a statistical life according to the region the data was taken from. The cost-effectiveness of these programs is then demonstrated by simulating what locally designed and constructed generators would cost and comparing that the amount of money that a government would traditionally spend to save a statistical life.

Oral Presentation

The Effects of the Affordable Care Act on Breast Cancer Survival Rates

Ryan Middleton
College of Science
Biological Sciences

Advisor: Allison Malloy, Carmel High School, Carmel, IN

Breast cancer is currently one of the most deadly diseases of the developed world. In response to the public health threat it presents, the Obama Administration, through the Affordable Care Act (ACA), attempted to make preventative care and insurance more accessible to the entire American population, as many women were forgoing mammography, a proven method of improving chances of survival. Due to concerns regarding the affordability of insurance, the Trump Administration is now proposing repeal and replacement of Obama's solution, under the argument that it was ineffective. The legislation had many wide-ranging impacts and the purpose of this research is to perform an in-depth evaluation of one of them, namely the effects on breast cancer. It seeks to determine the ability of the ACA to positively affect insurance ownership, mammography volumes, average stage of cancer discovery, and ultimately, death rates. Each of these four dependent variables is measured before and after implementation of the Affordable Care Act, which shows that the legislation failed to increase ownership of private insurance, but that it did increase mammography utilization, and did begin to marginally improve average stage of discovery and survival rates. Thus, based on these criteria, the law had at least started to achieve most of its goals, but revisions should be implemented to increase ownership of private insurance. Maintaining the ACA and the ideas it presents provides opportunity for further incremental impacts over time; revising it allows the government to build on the small positive effects it has already produced.

Oral Presentation

Effectiveness of Therapeutic Staurosporine on Inhibition of Budding and Replication of Lipid-Enveloped Viruses

Arwa Mohammad
College of Science
Science Preprofessional Studies
Mark Fraser
College of Science
Biochemistry

Advisor: Robert Stahelin, Indiana University School of Medicine – South Bend
and Dept. of Chemistry and Biochemistry

Since 1976, Ebola virus has caused cyclic outbreaks of hemorrhagic fever in Africa, with a mortality rate between 40 and 91%. The VP40 protein is the major matrix protein in lipid-enveloped Ebola and Marburg viruses and is necessary for viral egress and stabilization of the viral envelope. Localization of VP40 to the cell plasma membrane (PM) has been shown to induce exposure of phosphatidylserine (PS), a marker of cell apoptosis, on the outside of the cell surface. Ebola and Marburg viruses infect cells through a process known as viral apoptotic mimicry, in which exposed outer leaflet viral PS interacts directly with PS receptors on cells such as TIM1 or TIM4, or indirectly via bridging molecules to cell PS receptors such as AXL and TYRO3. Staurosporines are a class of drugs that have been shown to act broadly as kinase inhibitors and to deplete PS on the inner leaflet of the PM. This study uses a staurosporine drug that has reached Stage 2 clinical trials for cancers such as human epidermoid carcinoma, fibrosarcoma, and acute myeloid leukemia: 7-hydroxystaurosporine (UCN-01). Previous experiments in the Stahelin lab have shown that UCN-01 decreases VP40 localization to the PM. The effect of this drug on Ebola and Marburg VP40 VLP production and egress was investigated with the hypothesis that UCN-01 induced PS localization to the PM will reduce VP40 localization to the PM, causing a decrease in VLP production. To test this, HEK293 cells were transfected with Ebola or Marburg VP40 plasmids and then treated with 50nM, 100nM, 200nM, 300nM, or 400nM of UCN-01 for 18-24 hours, as well as untreated and DMSO vehicle controls. VLP collections were then performed and quantified via Western Blot analysis for VP40 content standardizing to cellular GADPH levels to determine if a reduction in VLP production had been achieved.

Oral Presentation

Immunomodulatory Role of PYGO2 in Prostate Cancer

William Morgenlander
College of Science
Biological Sciences and Physics
Shan Feng and Xin Lu, Dept. of Biological Sciences
Xiaolu Pan, Sunada Khadka, Eun-Jung Jin, and Rumi Lee, MD Anderson Cancer Center, Houston, TX
Xing Dai, University of California Irvine, Irvine, CA
Y. Alan Wang and Ronald DePinho, MD Anderson Cancer Center, Houston, TX

Advisor: Xin Lu, Dept. of Biological Sciences

Cancer genomics studies indicate that advanced prostate cancer (PCa) features rampant chromosomal instability, which is associated with poor prognosis. Functional drivers for many such chromosomal amplifications or deletions are unknown, so to identify such drivers, the Lu Lab previously performed an in vivo screen and identified over 20 hits as new putative PCa genes. Among them, we focused on PYGO2, which binds histone H3 and stimulates transcription through the recruitment of histone modifying proteins. Upregulation of PYGO2 has been described in skin, liver and lung cancer, and preliminary data confirmed that PYGO2 promotes PCa progression. To study PYGO2 during autochthonous PCa development, the Lu Lab generated a novel genetically engineered mouse model by crossing prostate-specific PYGO2 knockout into the aggressive Pten Smad4 PCa mouse model. Pten Smad4 PYGO2 triple knockout (TKO) mice had significantly longer survival and decelerated tumor progression as compared to Pten Smad4 double knockout (DKO). Histological analysis of TKO tumors showed decreased proliferation and increased total T Cell infiltration as well as an increased CD8+ cytotoxic T lymphocyte infiltration as compared to DKO. Additionally, through western blot analysis, we found that Yap1, which we previously showed regulates a chemokine pathway, was downregulated in TKO while two chemokines Cxcl2 and Cxcl15 were upregulated, suggesting a potential T cell recruitment pathway. These data indicate further experimentation on PYGO2, such as chromatin immunoprecipitation, to establish mechanisms underlying PYGO2 mediated prevention of T Cell infiltration to the tumor microenvironment. Furthermore, because advanced PCa develops resistance to checkpoint blockage immunotherapy in part due to exclusion of T Cells from the tumor microenvironment, combination of PYGO2 knockout with checkpoint blockade may yield synergistic effects in treating PCa and should therefore be tested using the TKO model.

Poster Presentation

Investigating the Relationship Between Hemispheric Brain Lateralization and Implicit Learning Performance

Maria Mosley
College of Science
Neuroscience and Behavior

Advisor: Kathleen Eberhard, Dept. of Psychology

This study investigated the relationship between hemispheric dominance and implicit learning performance on a task involving non-adjacent dependencies. Hemispheric dominance was operationalized via a survey assessing consistency of handedness preference, with a higher degree of right-handedness corresponding to increased left-hemispheric dominance. Subjects also reported whether they had left-handed relatives, as increased familial left-handedness (or *sinistrality*) negatively correlates with left-hemispheric dominance. A task utilizing an artificial grammar of nonwords was used to assess participants' ability to implicitly learn non-adjacent dependencies. Subjects were presented with series of these nonwords and later asked to predict which word would finish an incomplete series; unbeknownst to the participants, the first item was 100% predictive of the third item. Subjects who were better able to implicitly recognize this "grammatical" rule, then, displayed better implicit learning performance. Our preliminary results show a positive correlation between the degree of right-handedness (left hemispheric dominance) and implicit learning performance in male subjects only (r^2=0.61). Males with more left-handed family members, and therefore presumably lower left hemispheric dominance, also showed lower implicit learning performance (r = -0.3). These results are consistent with the hypothesis that a higher degree of left hemisphere dominance predicts higher accuracy on implicit learning tasks, as well as with past studies demonstrating a sex difference in hemispheric lateralization of language (see Hutt, 1979).

Poster Presentation

Targeting the HSP70 family to overcome chemoresistance in Pancreatic Ductal Adenocarcinoma (PDAC)

Gabrielle Mungcal
College of Science
Biological Sciences
Jenifer Gifford
College of Science
Biological Sciences

Advisor: Reginald Hill, Dept. of Biological Sciences

Pancreatic adenocarcinoma (PDAC) is the 3rd leading cause of cancer related death in the United States, with a five-year survival rate of just 9%. Further, 74% of patients treated with gemcitabine (GEM), currently the most widely used adjuvant therapy for treating PDAC, experience tumor recurrence. Our previous work has shown that chemoresistance and tumor relapse in PDAC are regulated by GRP78, a molecular chaperone that is a member of the HSP70 family and an alleviator of endoplasmic reticulum (ER) stress. ER stress helps cells survive situations that induce extreme duress, such as those encountered during exposure to chemotherapy. Moreover, increased GRP78 expression leads to chemoresistance. We utilized an inhibitor of GRP78 function, IT-139, in combination with GEM, to reduce chemoresistance in PDAC cells. Furthermore, we found that use of this novel combination in vivo could significantly extend survival in a metastatic mouse model of PDAC. Despite the effective of this treatment, mice still ultimately succumbed to PDAC. Thus, we hypothesized that in the event of GRP78 inhibition, other HSP70 family members may compensate for GRP78 loss and rescue chemoresistance. We sought to eliminate these compensatory mechanisms through further inhibition of HSP70 family members by combination treatment with VER155008, a pan inhibitor of HSP70 family members, and GEM. Cell survival assays demonstrated that VER155008/GEM treatment had greater efficacy as compared to IT-139/GEM treatment. However, rather than observing decreased GRP78 expression following VER155008 treatment as we hypothesized, western blot analysis demonstrated that VER155008 treatment caused an increase in GRP78 expression in PDAC cells. In order to address these seemingly conflicting results, future experiments will involve investigating the downstream targets of VER155008 to determine the cause of its ability to increase the efficacy of GEM. Further, siRNA knockdown of individual and combinations of HSP70 family members in combination with GEM treatment will functionally determine the key players in ER stress associated chemoresistance.

Poster Presentation

Synthesis of Hyperbranched Polymers with Post-Functionalization Specificity

Hannah Naguib
College of Science
Chemistry and Classics

Advisor: Haifeng Gao, Dept. of Chemistry and Biochemistry

Hyperbranched copolymers are a type of promising polymer platform for achieving artificial light-harvesting. By subjecting an AB2 monomer system to substances such as coumarin 343 dye, Copper-Catalyzed Azide-Alkyne Cycloaddition (CuAAC) polymerization triggers the production of a core complex which serves as a strong interior for further functionalization. Subsequent layers gained through post-functionalization contribute to the polymer's specificity concerning light harvesting and absorption. The effects of stoichiometric ratios of AB2 monomer in the polymerization reactions are examined in order to infer the optimal ratio for the fastest polymerization kinetics with the highest conversion to hyperbranched polymer product. The monomer in this study contains two easily functionalized groups: a terminal alkene and a terminal alkyne. As a result, during the CuAAC homopolymerization process, the terminal azido groups present in the "A" portion of the monomer are able to react with either terminal group to form a hyperbranched polymer. Reactions between the terminal alkyne of one AB2 monomer and the azido group of another monomer are preferred within the CuAAC mechanism; however, with slow enough kinetics, reactions between the terminal alkenes present on the other "B" group of the monomer and an azido group are also possible. Copolymerization employs a different mechanism which consists of a B3 core upon which the rest of the polymerization expands. This method prevents the alkene-azido side reaction from occurring due to its faster kinetics and also introduces another level of design control by allowing the hyperbranched polymer size to be regulated. Upon copolymerization syntheses, these polymers underwent post-functionalization reactions such that they would mimic the outer shell created around the light-harvesting core complexes aforementioned.

Poster Presentation

Effects of Corrosion on the Strength of Metals

Maximilian Niebur
St. Anthony De Padua School

Metals often corrode when exposed to acid, which then causes them to fail or break. The purpose of my experiment was to test which metal, of aluminum, copper, steel, and brass, is most corrosion resistant, determined by the metric of how much strength was lost. The samples were cut to 7.62 cm by 0.635 cm with a notch cut in the middle to cause fracture. To determine which metal was most corrosion resistant, the samples were exposed to 1/3 molar citric acid for 24, 48, and 72 hours, then tested with a three-point bending test. After corrosion for 72 h the aluminum, brass and copper gained an average of 113 N in strength. The steel decreased by an average of 311.9 N. The amount of the time of the corrosion did not affect the results. The results show that either the citric acid worked as a strengthening agent to the aluminum, copper, and brass or the metals may have mixed during corrosion.

Poster Presentation

Genomic Profiling of Light-regulated Genes in the Malaria Mosquito *Anopheles gambiae*

Anthony Nguyen
College of Science
Neuroscience and Behavior
Dominic Acri
College of Science
Neuroscience and Behavior and Film, Television, and Theatre
Aaron D. Sheppard, Gary F. George and Erin Clark, Dept. of Biological Sciences

Advisor: Giles Duffield, Dept. of Biological Sciences

Mosquitoes of the *Anopheles gambiae* complex are major vectors of malaria in Africa. Our previous studies have revealed that patterns of behavior are regulated by photic stimuli and by the environmental light-dark cycle. Light presented during the night can affect the circadian clock and diel timing (Rund et al, 2013, BMC Genomics 14: 218), as well as suppress blood feeding (biting) and modulate flight activity in an acute and sustained manner (Sheppard et al, in review). To better understand the molecular basis for these sustained responses to light and how they are transduced in the eye and brain, we undertook a genomics analysis of mosquitoes exposed to a discrete photic stimulus presented during the early night. *An. gambiae* s.s. (Pimperena strain) and *An. coluzzii* (Mali-NIH strain) mosquitoes were exposed to a 10 min 300 lux pulse of while light at the onset of night and animals harvested at 30-minute intervals over a 2-hour period. RNA was extracted from mosquito heads and subjected to genome-wide high throughput RNA sequencing analysis. Differential gene expression (1.75-fold change up or down compared to dark [no light] controls) was observed in 401 and 351 genes of Pimperena and Mali-NIH mosquitoes respectively. Of these, 120 were shared between the two strains/species. Functional group analysis highlights genes involved in the circadian clock mechanism, feeding behavior, olfaction (smell), vision, and the Wnt signaling pathway (contributes to local signaling between neighboring cells). These data reveal a breadth of gene expression changes that likely underpin the coordinated responses of brain-behavior pathways to adapt to environmental change. A better understanding of these pathways that regulate time-of-day specific behaviors, that include human host-detection and blood-feeding, have implications for improving control of malaria transmission.

Poster Presentation

Optimizing IHC staining of leptin in *Hyla cinerea* testes

Alina Nguyen
College of Science
Neuroscience and Behavior

Advisors: Mary Chang and Sunny Boyd, Dept. of Biological Sciences

Optimizing immunohistochemical techniques is useful to account for different antigens and antibodies, especially in species or organs where the protein has not been yet documented. This study is optimizing a previous leptin staining protocol in the brain of *Xenopus laevis*, so that it can be applied to the staining of leptin-immunoreactive cells in the testes of *Hyla cinerea*. Different procedural steps, such as types of tissue fixation, blocking steps, durations of incubation, primary antibody concentrations, and DAB concentrations were varied in order to optimize the protocol. It was found that an optimal protocol was achieved with a primary incubation time of 24 hrs, an increase in primary antibody concentration to a 1:500 dilution, and an increase of DAB in the peroxidase substrate solution to 15 ul. These results have implications for future studies looking to incorporate leptin in amphibian models, especially the effects of leptin on physiological or behavioral characteristics.

Poster Presentation

Detecting Indels to Obtain Aaop1 and Aaop3 Mutant Lines of *Aedes aegypti*

Aileen O'Hayer
College of Science
Neuroscience and Behavior

Advisors: Joseph O'Tousa and Michelle Whaley, Dept. of Biological Sciences

The Aaop 1 and Aaop3 genes in *Aedes aegypti* code for rhodopsins Aaop1 and Aaop 3, important proteins for mosquito vision, utilized in the rhabdomeres of photoreceptors in *Ae. aegypti* adult and larval mosquito respectively. Creating mutant Aaop1 and Aaop3 lines will aid in the study of the role of visual input in mosquito behavior. Aaop1 or Aaop3 mutants in *Ae. aegypti* are obtained through targeted genome editing using CRISPR-Cas9 technology. *Ae. aegypti* eggs expressing Cas9 have been injected with an Aaop1 or Aaop3 gRNA plasmid. A double stranded break in the DNA at the target site is produced and then repaired through non-homologous end joining (NHEJ). Insertion/deletions (INDELS) may occur as a result of NHEJ causing a frame shift in the Aaop1 or Aaop3 open reading frame and producing a nonfunctional protein. Screening for INDELS through PCR is an efficient way to identify G1 mosquitos that are potential Aaop1 mutants. Genomic DNA is isolated by the CTAB method from individual G1 injected mosquitoes. PCR is then used to amplify the Aaop1 or Aaop3 cut site and run on a 3% agarose gel to distinguish between small differences in basepairs due to INDELS. Another method to determine the presence of an INDEL is using PCR with primers that flank the Aaop1 or Aaop3 cut site in a larger DNA segment of about 1kb. PCR amplifies both the INDEL and wildtype fragment due to the heterozygosity in the animal. This DNA is denatured and renatured, and hybrid wt/INDEL DNA will form. The T7 endonuclease then cuts the mismatched DNA and the size of the fragments are detected on 1% agarose gel. Once an INDEL is found, the DNA is sequenced to confirm the presence of a mutation before establishing the mutant line. Creating an Aaop1 or Aaop3 mutant line of *Ae. aegypti* mosquitoes leads to further studies in behavior, vector competence and disease transmission.

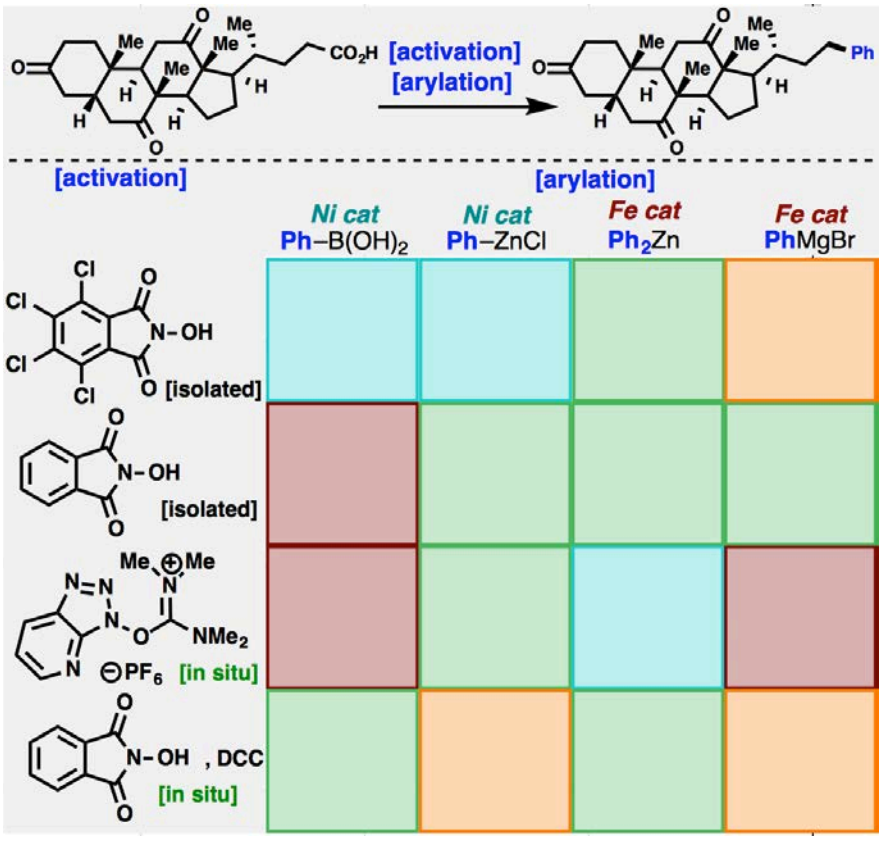
Oral Presentation

Decarboxylative Cross Couplings as Versatile Synthetic Tools

Matthew O'Neill
College of Science
Biochemistry
Phil Baran, Frederick Sandfort, and Josep Cornella, Dept. of Chemistry and Biochemistry

Advisor: Paul Helquist, Dept. of Chemistry and Biochemistry

While decarboxylative couplings have been reported for decades, their utility as synthetic transformations have increased dramatically during the past several years. Many studies have employed this reaction type within the context of photoredox catalysis, engaging a photocatalyst to promote further radical reactions. Less costly metals like nickel and iron thus provide an attractive alternative to expensive photocatalysts. Recently, the Baran lab has exploited this transformation utilizing cheap, readily available catalysts and developed a variety of methods that permit rapid construction of critical pharmacophores in a facile, reliable, and scalable manner. Crucial to the successful implementation of such methods is the generation of a "redox active ester", from which a carboxlyic acid functionality can yield a transient radical species capable of participating in various transition metal manifolds. The development of a "one-pot" methodology for this reaction is discussed, as is the development of a "user guide" for practitioners wishing to use such methods in their own work.



Poster Presentation

Role of mitochondrial transfer in breast cancer adaptation to the brain microenvironment

Treasa O'Tighearnaigh
College of Science
Biological Sciences
Wendy AlvarezBarrios, Dept. of Biological Sciences
Patricia Schnepp
College of Science
Biological Sciences
Erin Howe, Dept. of Biological Sciences

Advisor: Siyuan Zhang, Dept. of Biological Sciences

Breast cancer is the most commonly diagnosed cancer among American women, with a 1 in 8 lifetime risk of occurrence. The efficacy of treatment of primary tumors is dramatically improving, resulting in prolonged life span; however, given this increase in patient survival, the incidence of metastases is increasing as patients live long enough for metastases to develop. When breast cancer metastasizes to the brain or central nervous system, expected 5-year survival decreases dramatically (from 99% for patients with localized disease to 25% for patients with CNS metastases) and brain metastases account for 30% of breast cancer mortality. In breast cancer brain metastasis, interactions between tumor cells and glial cells (the main cell type present in the brain) appear vital to tumor growth and survival under the sub-ideal conditions presented by the unique brain microenvironment. However, the mechanisms through which glial cells support and alter tumor cells, particularly with respect to metabolism are poorly understood. One mechanism by which cells have been found to adapt to metabolic stress is through the transfer of mitochondria from stromal cells. Indeed, mitochondrial transfer has been observed in the central nervous system where glial cells have been found to transfer mitochondria to neurons following ischemic stroke to support neuronal cell viability and recovery. We hypothesize that the acquisition of mitochondria derived from glial cells to tumor cells confers a proliferative advantage to the tumor cells. To study this phenomenon, we have utilized an in vitro system where breast cancer cells are co-cultured with primary murine glial cells. We found that glia are able to rapidly transfer mitochondria to breast cancer cells. We further show that breast cancer cells have decreased proliferation and survival in low glucose/low glutamine growth conditions, which are more representative of the brain environment. Interestingly, the presence of glia provides a survival advantage, and allows the breast cancer cells to survive longer in this condition. Together, our findings suggest that mitochondrial transfer is a novel mechanism by which glial cells protect brain metastatic breast cancer cells.

Poster Presentation

Investigating the Relationship of Science Fair Participation on Students' Perceptions of Science

Allison Olshefke
College of Science
Physics

Advisor: Micha Kilburn, Dept. of Physics

The purpose of this project is to look for correlations between students' views of science and their participation in The Northern Indiana Regional Science and Engineering Fair (NIRSEF), which was directed by project authors Dr. Micha Kilburn and Alisa Zornig Gura. Through surveys administered at NIRSEF, we collected students' responses regarding their experience with the science fair as well as their responses to prompts that investigated their experiences with and perceptions of science. Additionally, we investigated the effects that parent and teacher assistance and mandatory participation had on student views of science and student performance at the fair (i.e. what ribbons or awards they received). Using Statistical Package for the Social Sciences, we analyzed the survey data to draw conclusions about the effectiveness and impact that science fairs and other out-of-classroom educational opportunities have on fomenting lasting interest in STEM.

Oral Presentation

Modeling Vortex Lattice Configurations in Superconductors by Molecular Dynamics Simulations

Maciej Olszewski
College of Science
Mathematics and Physics

Advisor: Morten Eskildsen, Dept. of Physics

When a type-II superconductor is subjected to a magnetic field it is threaded by vortices, each carrying one quantum of magnetic flux. In materials with low vortex pinning to defects, the vortices will arrange themselves into a regular array known as the vortex lattice (VL) due to their mutual repulsion. The VL depends sensitively on the anisotropy of the screening current plane, and in many cases undergo a structural phase transition as the magnetic field and/or temperature is varied. In material with a basal plane anisotropy the vortex-vortex interactions are depended on the angle and distance between two vortices. This creates a directionally dependent interaction potential that is crucial to the understanding of the lowest energy configuration of the VL. Using this concept, we created a molecular dynamics simulation that determines the most stable position of vortices for a given amplitude and orientation of the interaction anisotropy.

Poster Presentation

A Mechanistic Investigation of Osmium Catalyzed Alkene Bond Cleavage

Matthew Onders
College of Science
Biochemistry

Advisor: Seth Brown, Dept. of Chemistry and Biochemistry

Research in the Brown group has shown that osmium tetroxide is able to catalyze the oxidation of the double bond in stillbene derivatives to generate the corresponding benzaldehyde derivatives. However, the specific mechanism of this reaction remains unknown. In order to investigate this aldehyde generating cleavage, compounds such as pinacol and ethylene glycol were reacted with osmium tetroxide in an attempt to generate osmium bis glycolate complexes that did not immediately cleave. The ligands of the ethylene glycol complex were then exchanged with S,S-hydrobenzoin so that the complex imitated what occurred in the oxidation of stillbene. The reaction of this complex with NMO was then studied in order to see if any intermediates could be detected via NMR and to elucidate the kinetics of the alkene bond cleavage.

Poster Presentation

Plant-Pollinator Networks Change with Time in the Burnham Wildlife Corridor

Angela Pantell
College of Science
Anthropology, Economics, and Environmental Sciences
Chloe Takala, Dept. of Professional Studies, Roosevelt University, Chicago, IL
Sarah Nolimal, Dept. of Environmental Science and Studies, DePaul University, Chicago, IL

Advisor: Paula Tallman, Field Museum of Natural History, Chicago, IL

This study assessed restoration age as a possible mechanism for changes among pollinator presence over time in an urban environment. Plant and pollinator monitoring was performed in eight different sites of restored prairie throughout the Burnham Wildlife Corridor, a large natural area spanning Chicago's South Lakefront. Floral diversity and abundance, pollinator abundance, and plant-pollinator interactions were measured and compared across eight sites of ages ranging from zero to fourteen years. It was found that floral diversity did not correlate to the age of the site, or any other factors, but that floral abundance had strong positive correlations with age, pollinator abundance, and plant-pollinator interactions. This information can be expanded upon in more comprehensive studies in the future to further identify the underlying mechanisms between the increase in floral abundance and the accompanying increase in plant-pollinator interactions.

Poster Presentation

Finding Bright Low-Metallicity Stars in the Milky Way Galaxy

Erik Peterson
College of Science
Physics

Advisor: Vinicius Placco, Dept. of Physics

Even though astronomers have been searching for metal-deficient stars for decades, one of the most active fields in astronomy today is the quest for the most metal-poor stars in our Galaxy. These metal-poor stars are some of the oldest stars in our Galaxy and in the Universe, and they are important tools for studying the early stages of galaxy formation. As a result, astronomers need to develop novel ways to identify metal-poor stars. In my research, I have taken existing catalogs of bright stars with unknown metallicities and found metal-poor star candidates based on the attributes of known metal-poor stars. When spectral types were assigned for stars in the past, it was assumed that every star had the same chemical composition; however, this is not true. Changes in chemical composition introduce a mismatch between assigned spectral types and temperature. Because of that, the most metal-poor stars are the stars with the largest difference between the observed spectral types and the effective temperature. By analyzing the distribution of the numerical spectral types of a set of bright stars against their observed colors (which are a proxy for temperature) and comparing that with stars that have a known metal-deficiency, it is possible to identify new metal-poor star candidates. With this method, I analyzed databases of stars with unknown metallicities and identified candidates that have a higher likelihood to be ultra metal-poor stars based on the characteristics of the known metal-poor stars. Since these bright stars have a higher likelihood to be metal-deficient stars, they can be observed with high-resolution spectroscopy, and help paint a better picture of the early formation of our Galaxy.

Poster Presentation

Optimizing the Synthesis of Novel Pesticide Analogs and Evaluating Their Mosquitocidal Potential

Kyle Planck
College of Science
Biochemistry
Warren Family Research Center for Drug Discovery and Development

Advisor: Bruce Melancon, Dept. of Chemistry and Biochemistry,
Warren Family Research Center for Drug Discovery and Development

The role of mosquitos as disease vectors is a persistent challenge to global health, especially in tropical areas. To investigate the possibility of creating new compounds with the capacity to kill these organisms, we looked to the octopamine receptor, a GPCR present in invertebrates but not vertebrates. This protein had previously been targeted by formamidine insecticide molecules effective against mites and ticks, but these were removed from widespread usage due to unanticipated toxicity in other organisms. Because the octopamine receptor is also expressed in *A. aegypti*, we proposed a repurposing of these pesticide molecules to act specifically against mosquitos with less unintentional toxicity. By using CDM, the formamidine parent molecule, as a scaffold and intentionally altering chemical structures responsible for its toxic effects, we synthesized a new set of related compounds with novel side chains, substituents, and heterocycles. Prior literature detailing formamidine synthesis served as a basis, but the chemistry for each reaction was optimized for the best results. Compound purity was assessed using analytical methods such as LC-MS and ^{1}H NMR. Then, the compounds were screened for efficacy using *in vitro* and *in vivo* assays. Our screen found that only a handful exhibited lethality in live animals, and none of the compounds that significantly activated the target receptor overlapped with those that caused mortality. The next step in this research involves further assay development, rethinking the synthetic strategy, and in-depth *in silico* investigations to elucidate these molecules' structure-activity relationships and the pathways implicated in pesticide mechanisms of action.

Oral Presentation

Comparing the F-Spin Mass Model to Other Mass Models in the Z = 60 Range

William Porter
College of Science
Mathematics and Physics
Andrew Nystrom, Dept. of Physics

Advisor: Ani Aprahamian, Dept. of Physics

Nuclear masses and binding energies play an important role in nuclear science and the applications of nuclear science such as nuclear astrophysics. The reliable prediction of nuclear masses far from stability is particularly important for a better understanding of the rapid neutron capture process. We are exploring the implementation of a semi-empirical mass model based on the concept of F-Spin in nuclei. This model incorporates the evolution of shape in various regions of the chart of nuclides. Here, with the intent of better predicting nuclear binding energies near the bounds of our experimental knowledge, the F-Spin mass model uses a 9 parameter quadratic equation dependent on the third projection of F-Spin and proton number to evaluate the microscopic portion of all nuclear binding energies. Over 2300 isotopes are described by separation into 14 zones and we are able to generate predictions for nuclear masses with RMS errors of 324 keV. Predictions of the F-Spin model are then compared with a number of other mass models in the Z = 60 region.

Poster Presentation

Deja Food: Diet and Mandibular Biomechanics in Carnivorous and Folivorous Mammals

Gabriela Portmann
College of Science
Science Business
Kevin Ramos
College of Science
Science Preprofessional Studies and Studio Art and Design

Advisor: Matthew Ravosa, Dept. of Biological Sciences

Prior work suggests that mandibular robusticity is linked to a mechanically demanding diet. Bite and jaw-muscle forces vary with diet, and it is likely that variation in feeding behavior influences the distribution of cortical bone along the mammalian lower jaw. Surprisingly, there is a dearth of information about how food mechanical properties and feeding behavior influence variation in jaw proportions among diverse mammals, particularly folivores and carnivores. Using an adult interspecific sample of 5 carnivores (*Canis familiaris, Felis catus, Procyon lotor, Neovison vison, Didelphis virginiana*) and 5 folivores (*Oryctolagus cuniculus, Sylvilagus floridanus, Lepus americanus, Castor canadensis, Sciurus carolinensis*), microCT was used to determine a series of internal parameters that accurately reflect the biomechanical characteristics of the lower jaw, such as cortical bone area, areas of moment of inertia about the transverse and vertical axes, minimum cortical bone width, maximum and minimum area moments of inertia, and torsional rigidity. Comparisons of these cross-sectional measures at the symphysis, two premolar sites (P1, P2), and two molar sites (M1, M2) between carnivores and folivores were analyzed via ANOVA and least-squares bivariate regression ($p<0.05$). Results indicate that, at all 5 mandibular sites, carnivores have a significantly larger minimum width of cortical bone than folivores. At P1, carnivores also exhibit relatively greater torsional strength. These findings suggest that feeding behaviors that involve the processing of living prey may result in unpredictable loading patterns that are best countered via a more uniform distribution of cortical bone throughout the lower jaw. As the premolars in carnivores are often in emphasized in prey capture and grasping, it is perhaps not surprising that this mandibular region is designed to resist greater axial torsion. Our study indicates that future research on the mammalian masticatory system should account for the role of feeding behavior in explaining evolutionary variation in the mandible.

Poster Presentation

Hypothalamus-Pituitary-Adrenal (HPA) Axis Activity and Depressogenic Variables in a Sub-Clinical Population

Natalie Pottschmidt
College of Science
Neuroscience and Behavior and Studio Art and Design

Advisor: Michelle Wirth, Dept. of Psychology

Problem or Major Purpose: Research about the developmental course of depression is vital for understanding and treating the disorder, yet we are far from an established model. Many theories of depression development share stress as a common theme; accordingly, dysregulation of the primary stress response system, the hypothalamic-pituitary-adrenal (HPA) axis, is considered a well-established marker of depression. However, the nature of this dysregulation is as varied as the symptoms of depression themselves: studies have reported patients displaying over- and underactive stress systems, as well as some who show no difference from healthy controls. The current study aims to characterize HPA axis activity in correlation with various factors implicated theories of depression development, rather than focusing on strict diagnosis.
Procedure: College undergraduates were randomly assigned to either a social stress test or a control task. Saliva samples were then taken to capture cortisol responsiveness to stress. That night, participants returned for an overnight session in the lab, and saliva samples were collected again in the morning to capture the cortisol awakening response. Participants also completed several questionnaires assessing various depression-related constructs.
Results or Expected Results: I expect to see no difference in cortisol production patterns between healthy and depressive groups, as determined by the Beck Depression Inventory-II. Instead, I predict that any differences in HPA axis activity among participants will be explained by individual depressogenic factors.
Conclusions and Implications: This research may help to inform the theory behind HPA axis dysregulation in depression patients by elucidating whether the associations found in the literature are due to particular symptoms. If specific groups of factors are correlated with hypo- or hyperactivity of the HPA axis, this could provide a biological means of treating patients displaying those symptom types.

Oral Presentation

Improving Comprehensive Emergency Obstetric and Neonatal Care (CEmONC) Practices through Retrospective Analysis of Intrapartum Stillbirth Data at the Fort Portal Regional Referral Hospital, Southwesten Uganda

Abigail Radomsky
College of Science
Biological Sciences

Advisor: Lacey Ahern, Dept. of Biological Sciences

From 2013 to 2015, the rates of intrapartum stillbirths of normal birthweight babies (2,500g+) at Fort Portal Regional Referral Hospital (FPRRH) increased from 12.1 to 19.2 per 1000 total births, indicating a gap in care during labor. To identify these gaps in care, a retrospective analysis was conducted using the BABIES (Birthweight Age-at-death Boxes for Intervention and Evaluating System) Matrix Methodology. The BABIES Matrix Methodology is a process that uses birthweight and age at death to define newborn health problems, select interventions, and monitor and evaluate those interventions. In 2015, 118 cases of intrapartum stillbirths of normal birthweight babies were identified but only 40.7% of the patient case sheets were found and few were entirely complete. The lack of detailed record keeping and organization resulted in a reduction of data for analysis. In addition to affecting this study, the lack of complete record keeping may be affecting quality of care at FPRRH because of the inability to properly follow a mother throughout labor and delivery. Additionally, high rates of common complications such as abnormal lie, obstructed labor, ruptured uterus, or cord prolapse, as well as a lack of adequate staffing often accompanied intrapartum stillbirths. The lack in adequate staffing could be explained by the fact that from 2013 to 2015 the total number of births at the facility increased from 4,750 to 6,824 and the facility is visibly overcrowded. These findings suggest a gap in care when complications arise and CEmONC practices must be followed, which could be attributed to overcrowding at the facility. To improve CEmONC practices and lower intrapartum stillbirth rates, detailed record keeping for continuous analysis, including use of the partograph and perinatal death audits is suggested. Additionally, non-emergent births should be distributed to lower-level health facilities to combat issues of overcrowding. These interventions may allow for improvement of care during labor, and any improvement should then be monitored with continued use of the BABIES matrix.

Oral Presentation

Sensitivity of p-nuclei abundance calculations to statistical model parameters

Brandon Roach
College of Science
Physics

Advisor: Anna Simon, Dept. of Physics

Many reactions relevant to astrophysics involve nuclei far from stability, and their cross sections must therefore be calculated numerically for input into large-scale stellar nucleosynthesis calculations. Recent work, especially regarding p-process nucleosynthesis, has shown that the observed astrophysical abundances of certain p-nuclides differ by almost a factor of 10 from those predicted by network calculations using the recommended reaction rates. Additionally, significant differences between calculated abundances when using different versions of these rates have been obtained. We therefore present the abundances of p-nuclei calculated using the open-source NucNet Tools code for a 25 solar-mass type-II supernova model, incorporating reaction cross sections calculated using the statistical-model code TALYS for several level density models (LDM), α-optical potentials (OMP), and γ-strength functions (GSF).

Poster Presentation

The Role of Iron in Neuronal Development

Samuel Rudisill
College of Science
Neuroscience and Behavior
Saam Mojtahed
College of Science
Neuroscience and Behavior

Advisor: Charles Tessier, Indiana University School of Medicine - South Bend

Autism spectrum disorders (ASDs) are mental illnesses characterized by impairment in various cognitive skills including communication, forming relationships, and understanding language and abstract ideas. Over the years, multiple reports have shown that deficiencies in certain trace metals are associated with autistic patients. In particular, low maternal iron during pregnancy was found to be a risk factor for the disorder. Iron is well known to be required for proper neuronal development, however it has not been determined whether iron affects the brain directly. We are therefore studying the role of iron in neuronal development in the well-characterized *Drosophila* model of Fragile X Syndrome (FXS). FXS is an ASD and is caused by the silencing of the fragile X mental retardation (FMR1) gene. We are investigating the synaptic development of the *Drosophila* small ventral lateral neurons, which comprise a circuit involved in regulation of circadian activity. We are analyzing the role of iron by manipulating dietary levels of this metal via supplementation or chelation to determine how changes in iron content affect the structure of this system. This study intends to improve our understanding of the mechanisms underlying FXS and neural development to create opportunities for more innovative therapeutic targeting and pharmacological development.

Oral Presentation

The Control Software for the iLocater Spectrometer

Elliott Runburg
College of Science
Mathematics and Physics
Brian Sands, Jonathan Crass, and Justin Crepp, Dept. of Physics
Elwood Downey, Dept. of Astronomy and Steward Observatory, University of Arizona, Tucson, AZ

Advisor: Justin Crepp, Dept. of Physics

The iLocater instrument is a Doppler radial velocity spectrometer that is diffraction-limited, and works at near-infrared wavelengths. A single-mode, fiber-fed spectrograph that will achieve incredible precision, iLocater will be installed at the Large Binocular Telescope in Arizona, where it can be used on a wide variety of projects related to the search for Earth-like exoplanets. iLocater's software requirements include the need to handle a large amount of data, collected from both the instrument and the Large Binocular Telescope, and the ability to present the data in a clean and efficient manner. In this presentation, we introduce iLocater's control software architecture, which will be implemented using the Instrument Neutral Distributed Interface (INDI). INDI is a communications framework that controls the flow of messages between individual drivers and the user interface. INDI is implemented through back-end drivers, which control the instrument, and a front-end web interface, which grants users control of iLocater.

Poster Presentation

Daily Journaling and Depressive Symptoms: Writing in Third Person Leads to Increases in Depressive Symptoms Compared to First-Person Writing, Particularly for Cognitively Vulnerable Individuals

Maria Sasso
College of Science
Neuroscience and Behavior
Annaleis Giovanetti
College of Arts & Letters
Neuroscience and Behavior
Andrea Alatorre
College of Science
Neuroscience and Behavior

Advisor: Gerald Haeffel, Dept. of Psychology

According to the cognitive theories of depression (Abramson et al. 1989; Noklen-Hoeksema 1991), some individuals have a cognitive vulnerability that increases their likelihood of developing depression. Specifically, people are vulnerable to depression because they have a tendency to generate negative interpretations of stressful life events. Prior studies indicate that cognitive vulnerability is a potent risk factor for depression (Haeffel et al. 2008). It is critical to develop strategies for reducing this risk factor. The current standard is Cognitive Behavioral Therapy (CBT). CBT is as effective as medication and has lower relapse rates, however is expensive and requires a trained therapist. To address these shortcomings, this study tested the effectiveness of self-distancing journaling to prevent depressive symptoms. Prior research suggests that journaling decreases negative mood; it is also free and can be completed without the help of a trained professional. Specifically, we hypothesized that self-distancing about the implications of stressful events would help individuals to generate less negative interpretations of stress and, in turn, experience fewer depressive symptoms. To test our hypothesis, we used a daily diary experimental design and randomly assigned participants to three conditions: self-distancing (third person journaling), traditional (first person journaling), and control (no journaling). In both writing conditions, participants were instructed to write about stress in the first person or third person (depending on condition) every day for two weeks. As expected, we found a significant effect of writing condition on level of future depressive symptoms. However, the pattern of results did not conform to hypotheses. Individuals in the self-distancing condition reported significantly greater levels of depressive symptoms after the intervention than those in the first-person and no-writing control conditions. This effect appears to be driven by those with high levels of cognitive vulnerability. The implications of these findings are discussed and future directions are addressed.

Poster Presentation

Enhancing Cytotoxic Chemotherapy Response through Targeted Inhibition of Angiogenesis in Preclinical Models of Cholangiocarcinoma

Emily Scire
College of Science
Biochemistry
Sheena Monahan and Andy Wang,
Dept. of Surgery, Indiana University School of Medicine - South Bend
Margaret Schwarz, Dept. of Pediatrics, Indiana University School of Medicine - South Bend
and Harper Cancer Research Institute,
Roderich Schwarz, Dept. of Surgery, Indiana University School of Medicine - South Bend
and Goshen Center for Cancer Care, Goshen, IN
Niranjan Awasthi, Dept. of Surgery, Indiana University School of Medicine - South Bend
and Harper Cancer Research Institute

Advisor: Niranjan Awasthi, Dept. of Surgery, Indiana University School of Medicine - South Bend
and Harper Cancer Research Institute

Cholangiocarcinoma (CCA), or bile duct cancer, is the second most common primary liver cancer after hepatocellular carcinoma (HCC) and its incidence is increasing in Western countries. Gemcitabine with cisplatin remains the standard of care treatment with a median survival of only 14-months, warranting further evaluation of novel and effective therapeutic strategies. Aberrant signaling of growth factors has been shown to play a crucial role in CCA progression. Nintedanib, a triple angiokinase inhibitor of VEGFR1/2/3, FGFR1/2/3, and PDGFRα/β, has shown antitumor activity in multiple cancer types. Cabozantinib, a small-molecule inhibitor of c-Met, VEGFR2, Axl, Ret and Kit, is an approved therapy for thyroid cancer and renal cell carcinomas. We evaluated the antitumor efficacy of the GemCis chemotherapeutic regimen in combination with nintedanib or cabozantinib in preclinical CCA models. In vitro cell proliferation analysis in human CCA cell lines, intrahepatic CCLP-1, extrahepatic TFK-1, and perihilar Mz-ChA-1, revealed that GemCis and single agent nintedanib and cabozantinib are capable of inhibiting cell viability; in combination with GemCis, the effects of nintedanib and cabozantinib were compounded in some cell types. Western blot analysis revealed that CCLP-1 cells treated with nintedanib or cabozantinib alone or in combination with GemCis had increased expression of apoptotic marker proteins cleaved PARP-1 and cleaved caspase-3, and decreased expression of phospho-ERK and phospho-AKT. Overall, this data indicates that the combination of antiangiogenic agents nintedanib or cabozantinib with the chemotherapeutic regimen GemCis will have an additive antitumor response in CCA. Evaluation of the combination therapy benefits of nintedanib or cabozantinib with GemCis on tumor growth inhibition is currently ongoing in human CCA xenografts in NOD/SCID mice. In conclusion, the present study demonstrates advantages of combining multitarget antiangiogenic agents with the standard chemotherapy regimen for CCA treatment, and supports the rationale for in vivo evaluation of these therapeutic combinations for clinical CCA therapy.

Poster Presentation

Creation of Knockout Arrestin 1 and 2 mosquitoes to understand the importance of light mediated rhodopsin movement in *Aedes aegypti*

Ryan Seay
College of Science
Biological Sciences
Caitlin Harrington
College of Science
Biological Sciences

Advisors: Michelle Whaley and Joseph O'Tousa, Dept. of Biological Sciences

Aedes aegypti is the primary vector for diseases including dengue fever, yellow fever, and zika virus. To determine the role of arrestins in the *Aedes aegypti* visual system, our research aims to create mutants for Arrestin 1 and 2 (arr1 or 2) using the CRISPR/Cas9 system. In Drosophila photoreceptors, arrestin moves into the rhabdomeric membranes and quenches the phototransduction cascade by binding to rhodopsin. It is thought that the endocytosis of rhodopsin by Arrestin helps mediate the rhodopsin translocation. To that end, our research has created two plasmid constructs, one for each Arrestin, that codes for a homology directed repair (HDR) cassette with Arr 1 or 2 homology arms, the guide RNA (gRNA) for Arr 1 or 2, as well as fluorescent markers. This construct has been introduced into a Cas9 line of *Ae. aegypti* embryos through microinjection. In a second strategy, the same construct has been transformed into *Ae. aegypti* using piggyBac (pBac) mediated transposable element transformation. This transformant carrying the HDR and guide RNA will then be mated to Cas9 adults to create the mutants. A series of matings will occur to produce the final homozygous mutant. This mutant is created from an insertion of the HDR construct resulting in a frameshift, disrupting the start codon of Arr 1 or 2. By the end of the semester, we hope to have mutants for both Arr 1 and 2 and will be in the process of characterizing the mutants through western blot analysis.

Poster Presentation

The Role of Gastrokine-1 in Susceptibility to Colitis

Kara Shannon
College of Science
Neuroscience and Behavior and Theology

Advisors: David Boone and Anne-Marie Overstreet, Indiana University School of Medicine – South Bend

Gastrokine 1 (GKN1) is a protein produced in the stomach where it is secreted into the lumen and traverses the entirety of the gastrointestinal tract. Mice lacking GKN1 display leaner body compositions than wild type mice, but are otherwise healthy. Previous investigation has shown the positive effects of GKN1 in improving IL-10-/- and T-cell transfer mediated colitis in mice. This study aims to investigate if the lack of GKN1 protein affects the susceptibility of mice to TNBS-induced colitis. WT and Gkn-/- mice were treated with 2,4,6-trinitrobenzenesulfonic (TNBS) acid to induce colitis. This was done via a rectal infusion of 2.5% (w/v) solution of TNBS and ethanol to pre-sensitized 9 week old male and female WT and Gkn-/- mice. Control mice received a water and ethanol infusion. Morbidity and weight of mice was monitored daily, and mice were necropsied at either two or seven days post-infusion. After necropsy, colons were removed and observed for morphological changes. Sections of removed colons were fixed in formalin and histologically examined for signs of inflammation. Results showed increased susceptibility in Gkn-/- mice to TNBS-induced colitis compared to WT mice. TNBS-treated Gkn-/- mice had a 40% survival rate compared to the 75% survival rate observed in TNBS-treated WT mice. There was no significant difference in weight loss between the WT and Gkn-/- groups. Anatomical observation of the colons showed that Gkn-/- mice had colonic thickening and shrinkage as indicated by decreased length compared to WT mice. This supports the implication of GKN1 protein in susceptibility to TNBS induced colitis. Gkn-/- mice were more susceptible to colitis than WT mice as indicated by increased mortality, shorter shrunken colons, and colonic thickening. WT mice possessing the GKN1 protein exhibit an increased immune protection against TNBS-induced colitis.

Poster Presentation

Quantifying Diacetyl in Commercial Products with Paper Analytical Device

Caroline Sherry
College of Science
Science Preprofessional Studies

Advisor: Marya Lieberman, Dept. of Chemistry and Biochemistry

The usage and concentration of unnecessary chemicals and carcinogens are often hidden under general classifications such as “food additive” or “natural flavoring”. One such chemical is diacetyl (2,3-butanedione), which is linked to neurodegenerative diseases and is a direct cause of pulmonary diseases. It is added with minimal regulation as butter flavoring in everyday products including food, beverages, cooking sprays, gum, and electronic cigarettes. Chronic exposure to diacetyl puts individuals at significant risk for lung disease and cancer. Developing an inexpensive, accessible paper analytical device (PAD) that qualitatively tests the concentration of this carcinogen can help address this public health issue, which has significant financial and medical consequences. Preliminary methods involved synthesizing 4,5-dimethylimidazole, whose color intensity indicated the relative product formation. Creatinine and its precursor creatine were independently tested with permutations of diacetyl, α-naphthol, and potassium hydroxide. Product formation was found to be dependent on base-catalysis and maximized with creatine. The chemical structure of creatine supported this finding: it is an open polymer with lower activation energy than creatinine, an aromatic compound with substituents. The reaction was successfully adapted from an aqueous environment to dry-chemistry: rapid, vivid color transformation confirmed strong production of imidazole product. The most effective sensitivity test used creatine and potassium hydroxide, which were stored on the analytical device and reacted with different concentrations of diacetyl. Product formation was evaluated qualitatively and with graphical analysis to construct a sensitive standard curve for diacetyl concentration. Upcoming research will focus on further standardizing this reaction for commercial testing. Further experiments are needed to increase replicability of the reaction with different forms of diacetyl samples. Following this confirmation, this device will be manufactured to enable consumers to become self-informed about commercial diacetyl levels and incentivize companies to remove it from their products.

Oral Presentation

Feasibility of Computer Cognitive Training in Adults: Roles of sleep and psychological distress. Pilot Investigation on the Effects of Computerized Cognitive Training on Healthy Individuals and Implications for Application in a Clinical Population

Harisa Spahic
College of Science
Anthropology and Biochemistry

Advisor: Pascal Jean-Pierre, Dept. of Behavioral Sciences and Social Medicine, Florida State University

Objective: To assess the feasibility of computerized cognitive training program (CCTP), BrainHQ, to improve cognitive function, and to describe the relationship between depression, anxiety, and sleep with cognitive function. Methods: Adults (N=23) participants were recruited and provided signed informed consent to participate in the CCTP at the Cancer Neurocognitive Translation Research Lab (CNTRL, a.k.a. Jean-Pierre Lab). Participants were randomly assigned to 8 weeks of CCTP, using BrainHQ, training that occurred 3 times per week for 30 minutes or a behavioral control group (i.e., watching educational videos 3 times a week for 30 minutes). We assessed brain and cognitive function using functional near-infrared spectroscopy (fNIRS), the Repeatable Battery for Neuropsychological Status (RBANS), and other behavioral measures at 3 time (i.e., baseline, first follow-up (8 weeks past baseline), and second follow-up (12 weeks past baseline)). Statistical analysis included two-tailed t-tests and One-way ANOVA to determine significant findings (p<0.05). Results: Average baseline Total RBANS scores were 100.70 +/- 12.83 for the study sample. Interestingly participants classified with subclinical insomnia through the Insomnia Severity Index (ISI) performed better on the attention subscale of the RBANS compared to those without insomnia (t=2.71, df=8.42, p=0.0254). Overall, those with subclinical insomnia performed better on RBANS; however, the results were non-statistically significant (p>0.05). Furthermore, healthy participants classified with abnormal depression or anxiety through the Hospital Anxiety and Depression Scale (HADS) performed better on RBANS, but these results were non-statistically significant as well(p>0.05). We found no statistically significance based on scores on Need for Cognition Scale (NCS) and Cognitive Failures Questionnaire-Memory and Attention Lapse (CFQ-MAL) (p>0.05). Conclusion: Sleep is implicated in cognitive abilities related to attention. Further research is needed with larger samples to help described the interaction of the numerous variables researched above.

Poster Presentation

FFT Analysis in Energy Systems for Smart Grid Control using Multiple Storage Devices

Robert Stiller
College of Science
Physics
Abigail Mechtenberg, Dept. of Physics

Advisor: Abigail Mechtenberg, Dept. of Physics

A FFT analysis of yearly power loads and sources data results in unexpected key frequencies. These unique frequencies correspond to specific storage devices. This analysis demonstrates the need for hybridization of energy storage devices for optimal control of a smart grid. Furthermore, the juxtaposition of the FFT analysis of energy sources and loads yields a straightforward discussion about the disconnect between loads, storages, and sources. Unlike other research focusing on energy sources and/or power loads with one or two storage devices, this research demonstrates the superiority of an energy systems based approach to storage over a component-based approach. Future smart grids must include hybridization of storage to deal with noise versus vital system behavior and this FFT analysis seems promising moving forward.

Oral Presentation

Calculations of Absolute Transition Probabilities

Anne Stratman
College of Science
Mathematics and Physics

Advisor: Ani Aprahamian, Dept. of Physics

A transition probability is the probability that an unstable nucleus spontaneously transitions from an excited energy state to a lower energy state. Calculations of transition probabilities are extremely important in nuclear physics, since they provide information about the collectivity of a particular excitation. The absolute transition probability depends on the lifetime of a quantum nuclear state, the energy of the transition, and the intensity of a given transition depopulating a specific state. I have focused on the calculation of absolute transition probabilities, or B(E2) values, for gamma rays depopulating states in the 156Gd nucleus. The approach can be generalized and applied to any nucleus where the lifetime and the intensity of a depopulating gamma ray are known. In addition, the multipolarity of a given gamma ray transition is important for calculating these absolute transition probabilities. The multipolarity of a transition describes the properties of the gamma ray leaving the nucleus, and accounts for whether the gamma ray is electric or magnetic radiation. For transitions emitting a mixture of electric and magnetic gamma radiation, the multipole mixing fraction measures the mixing of the different multipolarities in an observed gamma radiation. My work to date focuses on developing a code, in the Python programming language, to calculate the transition probabilities of excited states of various nuclei given all the other information. Much of my research has involved editing an existing Python code, written to calculate transition probabilities, that does not yet take the uncertainty into the multipole mixing fraction into account. My work focuses on rewriting the code to account for this uncertainty. My group's overall goal in developing this code is to publish a program that can be used to calculate the transition probabilities for excited states of any given nucleus.

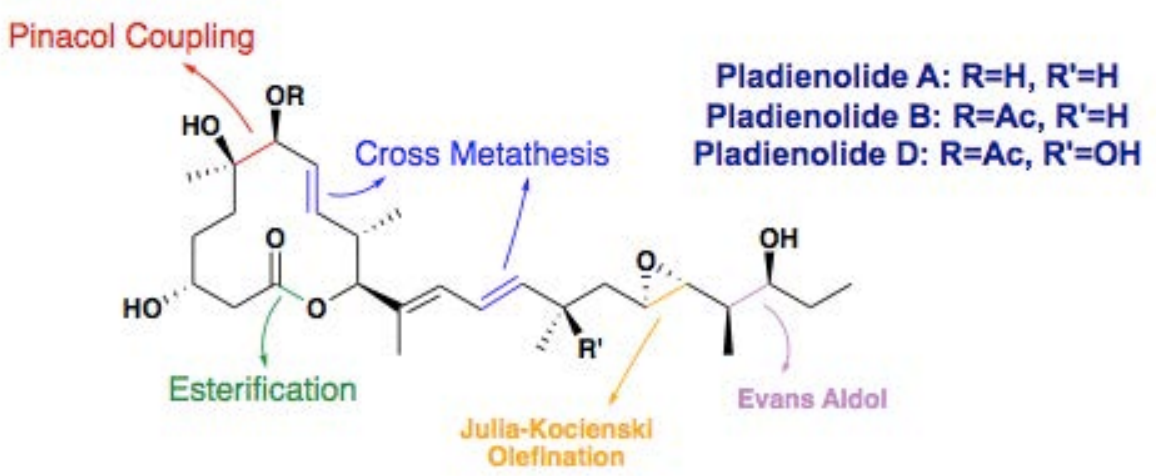
Poster Presentation

Total Synthesis of Pladienolide: A Potent Spliceosome Inhibitor for the Therapeutic Treatment of Niemann-Pick Type C Disease

George Timmins
College of Science
Anthropology and Chemistry
Eve Granatosky
College of Science
Biochemistry
Patrick Lichtenberger, Dept. of Chemistry and Biochemistry

Advisor: Richard Taylor, Dept. of Chemistry and Biochemistry

Natural products have been useful compounds for drug development. GEX1A, isolated from Streptomyces chromofuscus, has been shown to have corrective effects on cholesterol blockage in GM03123 NPC1 mutant fibroblasts suggesting its therapeutic potential for the treatment of Niemann-Pick Type C (NPC) disease. Pladienolide, isolated in 2004 from Streptomyces platensis, has been previously shown to have remarkable structural similarities to GEX1A. Furthermore, these natural products display similar biological similarities targeting the SF3b complex associated with the spliceosome. We propose pladienolide may exert similar pharmacological activities on the NPC phenotype through the modulation of alternative splicing. In order to evaluate the activity of pladienolide in the NPC phenotype, our current efforts have been in synthetic chemistry highlighted by Evans aldol, Julia-Kocienski olefination, pinacol coupling and cross metathesis to couple the side-chain moiety to the macrolide.



Oral Presentation

Interactions and competitive growth within mixed infections of *Plasmodium falciparum*

Abigail Tirrell
College of Science
Biological Sciences
Lisa Checkley, Dept. of Biological Sciences
Marina McDew-White, Texas Biomedical Research Institute, San Antonio, TX
François Nosten, Shoklo Malaria Research Unit, Mahidol-Oxford Tropical Medicine Research Unit, Mahidol University, Mae Sot, Thailand
Timothy Anderson, Texas Biomedical Research Institute, San Antonio, TX

Advisor: Michael Ferdig, Dept. of Biological Sciences

Infections by multiple genetically distinct *Plasmodium falciparum* parasites are common in cases of human malaria. The dynamic interactions of parasites in mixed infections include competition between co-infecting strains and potential for selection of parasites with fitness advantages. With emerging artemisinin resistance, it is essential to understand the relative fitness of parasites exhibiting the delayed clearance phenotype that could influence their spread in populations. Polymorphisms in the pfkelch13 gene have been associated with resistance, although resistant parasites lacking pfkelch13 SNPs have been isolated. The competitive fitness of genetically distinct, slow clearance parasite isolate clones from Southeast Asia, with and without pfkelch13 mutations, were evaluated. Pair wise competitions were conducted using novel in vitro 96-well plate red blood cell culture methodology. Fragment analysis of DNA microsatellites using the CEQ 8000 Genetic Analysis System was performed to track the relative densities of each parasite throughout the competitions. Consistent competitive growth outcomes were found between in vitro 96-well plate and previous methodology. This method allowed for the Pair-Wise Win Rank (PWR) scoring of isolates based on competition outcomes. This study found a pfkelch13 wild-type, artemisinin resistant isolate to have the highest competitive fitness among all resistant and sensitive lines, suggesting an uncharacterized resistance confers a fitness advantage. Additionally, it was found that the pfkelch13 E252Q line had a higher competitive fitness than other pfkelch13 SNPs, including the C580Y SNP that has been most prevalent in resistant Southeast Asian populations. The addition of low-level artemisinin drug pressure to each of these competitions did not result in the competitive release of any isolate. This novel competitive growth methodology allows for the high throughput assessment of competitive fitness between natural isolates with different genetic variants associated with resistance to artemisinin drugs, and the results suggest a fitness advantage to an uncharacterized resistance and regional differences in fitness of pfkelch13 resistance mutations. Improved understanding of the fitness of isolates will promote a much deeper understanding of the spread of artemisinin resistance in parasite populations and direct targeted therapy against infections.

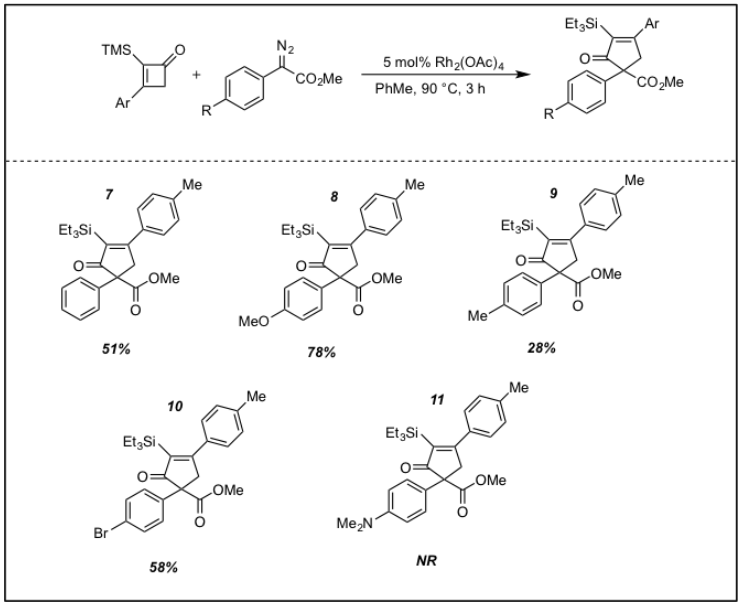
Poster Presentation

A Rhodium-Catalyzed Formal [4+1]-Cycloaddition Approach Toward the Stereoselective Construction of Quaternary Carbons

Tiffany Toni
College of Science
Biochemistry
Kevin Rodriguez
College of Science
Chemistry

Advisor: Brandon Ashfeld, Dept. of Chemistry and Biochemistry

Efforts have focused on the development of a rhodium-catalyzed formal [4+1]-cycloaddition to access privileged scaffolds of biological importance. This method requires the thermal ring opening of a cyclobutenone to generate a vinylketene *in situ*, which then undergoes a cyclopropanation event with a metal-carbenoid, followed by a ring expansion to construct a highly substituted cyclopentenone. The cycloadducts contain a synthetically challenging quaternary center embedded in a core pharmaceutically relevant scaffold that will form the basis for the discovery of novel anti-cancer chemotherapeutics. This approach has successfully been applied to synthesize cyclopentenone spirooxindoles and can be expanded to other donor-acceptor diazo compounds. The optimal conditions require an excess of cyclobutenone, likely due to decreased reactivity of the metal-carbenoid intermediates. This can be attributed to the elimination of the rigidity in ring structure in diazo oxindoles and reduced overall electrophilicity. Specifically, p-methoxy, p-methyl, p-bromo, and p-dimethylamino diazo oxindoles were tested. p-Methoxy had the highest yield of 78%, presumably because of the increased stabilization of the diazo substrate due to higher electron donation. p-Dimethylamino, on the other hand, yielded trace amount of product, perhaps because the amino group can interact with the rhodium catalyst, thus preventing the cycloaddition reaction. Further work involves testing the reactivity of heteraromatic substituted carbenoids and other metal catalysts.



Poster Presentation

Analysis of PTEN in a *Drosophila* Photoreceptor Model of Axonal Regeneration

Maria VanBerkum
College of Science
Neuroscience and Behavior

Advisor: Joseph O'Tousa, Dept. of Biological Sciences

A major focus of neuroscience today is understanding the cellular mechanisms of axonal regeneration after central nervous system (CNS) injury. After damage to adult CNS neurons, dual leucine zipper kinase (DLK), which controls the c-Jun N-kinase (JNK) pathway, mediates processes leading to either axonal degeneration or regeneration. This study is examining a potential strategy to promote axon regeneration after CNS injury by reducing activity of an inhibitory regulatory pathway. Here we are exploring axon regeneration in Drosophila melanogaster, where the DLK is named Wallenda (WND) and is required for JNK activation and therefore axonal regeneration following damage. Adult Drosophila photoreceptors respond to overexpression of WND by inducing axonal outgrowths similar to the WND- triggered response to injury in neurons. In other experimental systems, the occurrence of axon regeneration depends on the inhibitory regulators and intrinsic regenerative capacity of mature CNS neurons. The phosphate and tension homologues (PTEN) pathway is a neuronal intrinsic regulator of axon regeneration. PTEN deletion activates the mammalian target of rapamycin (mTOR) pathway, which is responsible for new protein synthesis needed for axon regeneration. This mechanism accounts for the enhanced axon regeneration that have been observed in mice retinal ganglion cells after PTEN deletion. In the present study, we are using RNAi suppression experiments to observe the effect of PTEN reduction during WND induced axonal regenerative responses. Our results will establish if PTEN modulation can be used as a potential strategy to improve outcomes after axonal injury.

Poster Presentation

Determining importance of in-lake CO_2 production for the carbon budgets in north temperate lakes

Joseph Vanderwall
College of Science
Environmental Sciences

Advisors: Jacob Zwart and Stuart Jones, Dept. of Biological Sciences

A majority of lakes are supersaturated with respect to carbon dioxide (CO_2) and act as a net carbon source to the atmosphere. CO_2 supersaturation is driven by CO_2 imported to lakes through surface inflow, groundwater inflow, and precipitation, and also by CO_2 generated in-lake by organisms utilizing organic carbon. Although the possible mechanisms of supersaturation are known, the relative importance of in-lake CO_2 production versus imported CO_2 is poorly understood and determining drivers of relative importance will help predict how lake carbon cycling will change under future climate and land use scenarios. In this study, we calculated average lake respiration rates derived from water sample assays and compared them to exogenous CO_2 influxes of twenty-eight temperate lakes using a coupled hydrology model. We found that production ratios varied among selected lakes, ranging from exogenous dominated to endogenous dominated with the median ratio of 0.82 indicating that a majority of lake supersaturation is driven by inflowing CO_2. Several lakes had negative CO_2 production within the lake, but remained supersaturated due to imported CO_2. Published literature suggests that this is due to high nutrient loading. Additional indicators of production ratios may include organic carbon, lake perimeter, and the prevalence of wetlands in the lake catchment. Looking forward, changing precipitation and hydrological patterns may impact the carbon loading of lake environments.

Poster Presentation

The development of a paper-based device for monitoring carbon monoxide

Albert Vargas
College of Science
Science Preprofessional Studies

Advisor: Marya Lieberman, Dept. of Chemistry and Biochemistry

Carbon monoxide (CO) is an air pollutant and human toxin produced by the combustion of biomass in stoves and furnaces and contributes to poor household air quality. Around 2.8 billion people worldwide rely on these methods for daily cooking and heating.
The passive electronic carbon monoxide detectors readily available for Western consumers are not necessarily a viable option in areas without a stable electricity supply. An alternative means for monitoring carbon monoxide levels must be developed, as the households with increased risk for elevated carbon monoxide exposure have the least access to monitoring technologies. A paper-based chemical test capable of colorimetric detection of carbon monoxide has the advantages of low-cost and simplicity. Tetrakis(acetamide)-palladium(II)-tetrafluoroborate, or Pd(II)-acetamide, is a reagent previously demonstrated to change color upon reduction by CO. This research had two goals: 1. to develop a method for manipulating gas concentrations within a sealed chamber in lab and 2. to demonstrate the effectiveness of Pd(II)-acetamide for detection and quantification of CO in a paper analytical device (PAD) format. Here, I report on the use of vacuum chamber evacuation and subsequent backfilling with CO and nitrogen gas (N2) in order to obtain a desired CO concentration at standard pressure. Gas chromatography (GC) was used to determine the accuracy and precision of CO dilutions. GC was also used to determine the stability of CO concentrations over time.
The effect of the following parameters on the response of Pd(II)-acetamide to carbon monoxide was also studied: CO concentration, mol Pd(II)-acetamide, and duration of exposure. A Pd(II)-acetamide degradation study over the course of 1-month was performed in order to further assess the reagent's viability in the PAD format.

Poster Presentation

Characterization of Metastatic Genes of Interest AMIGO2 and TENM2 for Ovarian Cancer

Kelly Volk
College of Science
Biochemistry
Eric Lee
College of Science
Science Business
Anne Grisoli
College of Science
Neuroscience and Behavior
Yueying Liu, Zonggao Shi, Dept. of Chemistry and Biochemistry
Xuejuan Tan, Dept. of Biological Sciences
Jing Yang, Dept. of Chemistry and Biochemistry
Chunyan Li, Dept. of Biological Sciences
Siyuan Zhang, Dept. of Biological Sciences

Advisor: Sharon Stack, Harper Cancer Research Institute and Dept. of Chemistry and Biochemistry

Ovarian cancer is often fatal due to its aggressive metastasis and late-stage diagnosis. Common symptoms mean that the cancer is often not properly diagnosed until it has reached stage III, by which time the cancer has spread beyond the pelvis to the abdomen and other organs. Only 39% of women receiving a stage III diagnosis will live for the five years following. To identify genetic factors that contribute to ovarian cancer metastasis, our laboratory has recently isolated cells selected in vivo for intra-peritoneal (IP) metastatic potential (termed IP cells). These cells are created in the lab from parental OVCAR5 or OVCAR8 cells by the alternating growth of these cells both in vivo and in vitro. After tumor growth in vivo, the host mouse is sacrificed and the cancerous organs harvested. Cells are cultured and the process is repeated two more times. IP cells get their name from the word "intraperitoneal" – the injection site on the mice. IP3 cells, used in these experiments, have been through three iterations of the mouse/culture process. We have recently discovered that these OVCAR IP3 cells have significant genetic differences from their parental OVCAR 5 or 8 counterparts, via next generation RNA sequencing.
This research focuses on the exploration and eventual treatment of ovarian cancer through first characterizing genes of interest that differ between the parental and IP3 cells. Out of a panel of genes found to display substantial quantitative differences, this study is focused on two genes, AMIGO2 and TENM2. Both of these are thought to play a role in tumor metastasis, as they are both heavily associated with the coding of cell adhesion molecules. qPCR amplification has already confirmed positive trends for the AMIGO expression in IP compared to parental cells in both lines. TENM2 is still in the process of being analyzed. Future experimentation will compare parental and IP3 cells with a panel of assays including adhesion, invasion, and migration, as well as in vivo growth. Modification of AMIGO2 and TENM2 expression (up- and/or down-regulation) will help define the role of these factors in ovarian cancer metastasis.

Poster Presentation

The Effect of Fertilizer on Grass Growth

Grace Weaver
Saint Pius X School

The purpose of my experiment is to demonstrate the effect of varying fertilizer on grass growth, as well as the effect of different soil-fertilizer combinations. Background research has shown that fertilizers have had a positive impact on plant growth. In addition to this, homemade solutions of varying ingredients have shown positive results on plants. My project is comprised of a control group (water), Treatment Group 1 (Miracle Grow), and Treatment Group 2 (Homemade Solution). Each group was exposed to similar growing conditions with varying soil types (Garden Soil with no added nutrients, sand, and clay soil). Plant growth was assessed with a basic height measurement. My hypothesis is that the Miracle Grow solution will produce a higher overall growth on each of the soil types. Comparisons were made daily for 5 days and were recorded. Day 1 growth: Control= clay: 0 cm, sand: 0 cm, and garden soil: 0 cm, Treatment Group 1= clay: 0 cm, sand: 0 cm, and garden soil: 0 cm, and Treatment Group 2= clay: 0 cm, sand: 0 cm, and garden soil: 0 cm. Day 2 growth: Control= clay: 0.8 cm, sand: 1.3 cm, and garden soil: 1.4 cm, Treatment Group 1= clay: 0 cm, sand: 1.35 cm, and garden soil: 0 cm, and Treatment Group 2= clay: 1.7 cm, sand: 1.2 cm, and garden soil: 1.5 cm. Day 3 growth: Control= clay: 2.5 cm, sand: 3.2 cm, and garden soil: 3.1 cm, Treatment Group 1= clay: 0 cm, sand: 2.6 cm, and garden soil: 0 cm, and Treatment Group 2= clay: 2.9 cm, sand: 2.99, and garden soil: 3.2. Day 4 growth: Control= clay: 4.12 cm, sand: 3.9 cm, and garden soil: 3.8 cm, Treatment Group 1= clay: 0 cm, sand: 3.15 cm, and garden soil: 1.75 cm, and Treatment Group 2= clay: 3.1 cm, sand: 3.25, and garden soil: 4.2 cm. Day 5 growth: Control= clay: 5.2 cm, sand: 5.6 cm, and garden soil: 6.2 cm, Treatment Group 1= clay: 0 cm, sand: 3.15 cm, and garden soil: 2.9 cm, and Treatment Group 2= clay: 4.9 cm, sand: 5.4 cm, and garden soil: 4.3 cm. In conclusion, grass exposed to pure water had an overall more positive effect on the grass growth than either of the other two solutions.

Poster Presentation

Novel correlation-based network analysis of breast tumor metabolism identifies the glycerol channel protein Aquaporin-7 as an inhibitor of breast cancer metastasis

Kristen Wehner
College of Science
Biochemistry
Laurie Littlepage, Dept. of Chemistry and Biochemistry
Jun Li, Dept. of Applied and Computational Mathematics and Statistics
Norman Dovichi, Dept. of Chemistry and Biochemistry
Jennifer Arceo
College of Science
Chemistry
Chen Dai
College of Science
Biochemistry

Advisor: Laurie Littlepage, Dept. of Chemistry and Biochemistry

The complex yet interrelated connections between cancer metabolism, gene expression, and oncogenic driver genes have the potential to identify novel biomarkers and drug targets with prognostic and therapeutic value. To develop a higher order understanding of the driver genes and metabolites in breast cancer, we next developed a correlation-based network analysis that captured interactions between both metabolite and gene expression data. Through this analysis, we uniquely identified a metabolic network of metabolites and genes that have prognostic value in breast cancer patients. Our network analysis identified 35 metabolite and 33 gene hubs that had the most network correlations. The gene and metabolite hubs identified by correlated network analysis are likely integral to breast tumor metabolism. We began investigating the role of the hubs during breast cancer and initially focused on the gene hub aquaporin-7 (Aqp7), a water and glycerol channel protein repressed during breast cancer, as a novel regulator of breast cancer. Deficiency in AQP7 in animal models is associated with adipocyte hypertrophy, increased glycerol and triglyceride accumulation, and insulin resistance, as well as increased obesity in mice and humans. We discovered that AQP7 is a prognostic marker of overall survival and metastasis in breast cancer patients. By immunohistochemistry, AQP7 localizes to the epithelium and adipocytes in normal and tumor breast tissue, with significantly reduced AQP7 expression in breast tumors. Next, using cell-based assays, we discovered that reduced expression of AQP7 inhibits contact inhibition and increases migration in mouse mammary epithelial cells. Reduced expression of AQP7 promotes increased branching in 3-D collagen culture models of mammary branching. Inhibition of AQP7 significantly increases the number of metastatic tumors in the lung. These data suggest that AQP7 inhibits invasive phenotypes of breast cancer progression. We also investigated the metabolite hubs by imaging the metabolites by MALDI mass spectrometry (MALDI-MS). We detected metabolites with distinct spatial resolution in both cancer cells as well as within the tumor microenvironment, suggesting regulated metabolic heterogeneity across tumor tissue. This imaging of metabolites within breast tumor tissue provides an unprecedented glimpse of the metabolite heterogeneity and spatial distribution within cancer cells and the tumor microenvironment.

Oral Presentation

Electrical Plasmas for Biomedical Applications

Elek Wellman
College of Science
Neuroscience and Behavior
Sylwia Ptasinska and Ek Adhikari, Dept. of Physics

Advisor: Sylwia Ptasinska, Dept. of Physics

Atmospheric pressure plasma jets (APPJs) are currently being investigated for their potential use as a clinical treatment method for cancer and abrasion therapies. The components of the ignited plasma, including radicals, charged particles and photons cause necrosis and/or apoptosis within exposed cells due to DNA damage. Previous studies have shown that atmospheric pressure plasma (APP) may be used to control cell adhesion, stimulate tissue ablation, tissue sterilization, blood coagulation, wound healing, and induction of apoptosis in cancer cells. The mechanisms by which APP produces these effects are not fully understood. In order to obtain an enhanced understanding of these mechanisms, it is important to understand the effects of APP on cells and subcellular components, primarily DNA. To study APPJ induced DNA damage, a helium plasma jet was used to create DNA breakage in an aqueous plasmid solution. Specifically, the effects of plasma pulse frequency and distance of the jet were evaluated. In addition, the significance of time under radiation was compared to pulse frequency. Agarose gel electrophoresis was utilized to evaluate the DNA damage in regards to single and double strand breakage. Our results show that an increase in frequency leads to a significant increase in single and double bond breakage. Changes in distance of the jet to the aqueous DNA solution appeared to have insignificant effects on DNA between the distances of 0.5 to 2 cm. When the number of pulses was held constant, time under radiation was more important than frequency of the pulses in regards to producing DNA damage.

Poster Presentation

Group Living and Parasitism in Amboseli Baboons

Christina Wells
College of Science
Science Business

Advisor: Elizabeth Archie, Dept. of Biological Sciences

Group living is often correlated with higher parasite prevalence and intensity. However, within groups, individual social connectedness is associated with greater health and longevity. However, we do not yet know if social connectedness is helpful or harmful to parasitism; greater social connectedness might increase parasite exposure but also improve individual health, which might make individuals less susceptible to parasites. By working in a well-studied population of wild baboons in Kenya, I test the hypothesis that social connectedness in baboons is correlated to higher parasite prevalence, intensity and diversity. I will test this hypothesis by utilizing traditional parasitology methods, such as floatation and sedimentation techniques for observing fecal parasites under a microscope. I will combine these data with measures of baboon social connectedness from the Amboseli Baboon Project's long-term data. My hypotheses will be supported if I observe higher levels of prevalence and intensity of various parasites including, *Trichuris trichiura, Strongyles, Streptopharagus pigmentatus*, and *Abbreviata caucasica*, and more diversity in the parasites for more social baboons. It is important to discover the relationship between sociality in baboons and parasite prevalence and intensity to determine the evolutionary advantage associated with group living. If my hypotheses are correct, there needs to be a benefit to group living that is higher than the cost of parasitism.

Oral Presentation

"The Help Never Reaches Us": A Case Study of Uganda's Foremost Sickle Cell Clinic

Matthew Weyenberg
College of Science
Science Preprofessional Studies

Advisor: Robert Dowd, Dept. of Political Science

Sickle cell disease is a genetic blood disorder that disproportionately affects those of African descent, and prevalence is extremely high in countries like Uganda. Sickle cell disease is a systemic condition that effects many different areas of the body through oxygen shortages, leading to high mortality rates when undiagnosed and unmanaged. This research explored experiences with sickle cell disease and sought to examine the strengths and challenges of treatment at Uganda's primary sickle cell clinic. This research was conducted at the Sickle Cell Clinic at Mulago National Referral Hospital in Kampala, Uganda in June-July 2016. Semi-structured in-depth interviews were conducted with 30 patients and caregivers and 7 different healthcare workers from the clinic. The research found that the clinic experiences many of the same resource shortages as its governing hospital, even in important services such as screening or supplying essential drugs. Most parents of patients at the clinic don't know the sickle cell status of their other children because they can't afford the test. Overall awareness and resources are severely lacking nationwide, partly because sickle cell doesn't have any of the funds or advocacy that illnesses like HIV receive. While patients must endure resource shortages at the clinic, they prefer to be treated at the specialized clinic over anywhere else. This research raises questions about the allocation of health and educational funding towards prevention and cost-efficient treatment, scaling diagnostic capabilities, and exploring comparative efforts to address sickle cell concerns.

Poster Presentation

Characterization of microglial recruitment, activation, and activity in the regenerating zebrafish retina

Kevin Wilkins
College of Science
Biological Sciences

Advisor: David Hyde, Dept. of Biological Sciences

Zebrafish are studied as a model for retinal regeneration, which does not occur in humans. After light-induced damage of photoreceptors in the zebrafish retina, Müller glia (the retinal resident stem cells) proliferate to give rise to neuronal progenitor cells (NPCs) and regenerate the damaged neuronal cell types. Microglia, the resident phagocyte population of the nervous system, have been until now regarded as bystanders in this process, but recent studies suggested they might play a more prominent role. While microglia have been studied in retinal degeneration models such as mouse and chick, they have not yet been fully characterized in the zebrafish regeneration model. The present study investigated the role and the interactions of microglia in the zebrafish retina with the goal of further understanding the mechanisms that lead to retinal regeneration. Before retinal damage, 4C4-stained microglia were detected in the retina were at an inactivated state, characterized by a highly-ramified shape with many processes. They were found throughout the retina, especially in the plexiform layers between the retinal nuclear layers. Zebrafish underwent a light-treatment to induce photoreceptor death and subsequent retinal regeneration. This process induced non-replicating microglia to migrate and be recruited to the site of photoreceptor death and become activated. Morphologically, active microglia assumed a less ramified shape, increased in mass, and displayed an amoeboid soma. Microglia recruitment paralleled spatially and temporally photoreceptor death and Müller glia proliferation, suggesting that microglial activation is prompted by dying photoreceptors and/or activated Müller glia. Microglial activity, which was suppressed by Dexamethasone, did not appear to be initiated by TNFα induced Müller glia proliferation in the undamaged retina. This suggests that some process upstream of Müller glia activation/reprogramming, such as neuronal cell death, is the stimulatory event for microglial activation. Further studies will be necessary to determine the mechanisms of activation and recruitment of microglia and their contribution to the regenerative process.

Poster Presentation

A network rewiring-based approach to differential gene coexpression in *Plasmodium falciparum* identifies components of artemisinin resistance

Philip Wilson
College of Science
Biological Sciences
Katrina Button-Simons, Lisa Checkley, Gabriel Foster, Sage Davis, Dept. of Biological Sciences
Timothy Anderson, Texas Biomedical Research Institute, San Antonio, TX
Marina McDew-White, Texas Biomedical Research Institute, San Antonio, TX
François Nosten, Mahidol-Oxford Tropical Medicine Research Institute

Advisor: Michael Ferdig, Dept. of Biological Sciences

Delayed clearance of *Plasmodium falciparum* to artemisinin, the front-line drug used to treat uncomplicated cases of malaria worldwide, signals the emergence of resistance, threatening current control efforts. Much attention has been given to the role of individual genetic loci as contributors to or modulators of resistance, but significantly less focus has been placed on the influence of expression changes in co-adapted suites of loci on resistance phenotypes. The coexpression of loci suggests a functional relation between the pair, potentially related to similar involvement of their products in cellular pathways or to evolutionary co-adaptation. In this study, the parasite transcriptional response to three treatment levels—half-maximal inhibitory concentration of dihydroartemisinin (DHA; the active metabolite of artemisinin), sub-inhibitory concentration of DHA, and a DMSO control—was characterized by microarray expression analysis for two strains displaying both fast and slow artemisinin clearance profiles. Expression profiles were grouped by parasite line across the three treatment conditions, and a Spearman rank correlation was performed of the relative transcriptional levels pairwise between all genes. A network was constructed for each parasite strain using significant transcriptional correlations between genes, and the genes that exhibited the greatest change in connectivity between the two networks were identified. These rewired genes were analyzed for gene ontology enrichment to identify functional components of networks with significant differences between the two strains, suggesting potential changes in biological activity that may accompany mutations necessary for artemisinin resistance. The identification of differently coexpressed *P. falciparum* genes may provide insight into the adaptations and expression compensations necessary to maintain fitness in parasite lines through the development of artemisinin resistance.

Poster Presentation

Investigating the role of gastrokine-1 as a link between gut microbiome, host metabolism, and obesity

Claire Wolford
College of Science
Biological Sciences

Advisors: David Boone, Indiana University School of Medicine – South Bend
and Dept. of Biological Sciences,
and Lisa Abernathy, Indiana University School of Medicine – South Bend

Gastrokine-1 (Gkn1) is a very stable protein made exclusively in the stomach. Gkn1 is secreted into the lumen of the stomach and transverses the entire length of the gastrointestinal (GI) tract. We previously generated Gkn1-/- mice to further examine the function of Gkn1 in vivo and have found that these mice are healthy and have a normal lifespan. However, Gkn1 knockout (Gkn1-/-) mice are resistant to weight gain on both high fat and normal diets, compared to Gkn1 wild-type (Gkn+/+) littermates. In addition, Gkn1-/- mice have normal appetite and physical activity, are not diabetic, and do not malabsorb fat or calories. Extensive studies from other groups have shown a link between the gut microbiome and obesity. Interestingly, data from our lab suggests that Gkn1 binds to the surface of microbes in the distal gut, indicating a role for Gkn1 in modulation of the gut microbiome and host metabolism. We hypothesize that Gkn1 alters the gut microbiome by binding a subset of microbes, resulting in modulation of host metabolism and resistance to obesity. This study aims to identify gut microbes that are bound to Gkn1 in an attempt to decipher how Gkn1 impacts the microbiome to affect obesity. To identify bacteria interacting with Gkn1 in the gut, we used fluorescence-activated cell sorting (FACS) with an anti-Gkn1 antibody to isolate Gkn1-bound luminal bacteria from the GI tract of wild-type mice. DNA was extracted from Gkn1-bound bacteria sorted by FACS and the 16S rRNA gene was PCR amplified. This bacterial 16S PCR product was cloned into a pGEX vector, transformed into bacteria, and the plasmid DNA containing the bacterial 16S sequences were analyzed using the Basic Local Alignment Search Tool (BLAST). These sequencing results from Gkn1-bound bacteria isolated from the GI tract will be compared against microbial genomes in databases. These data will allow us to determine how Gkn1 impacts the gut microbiome to affect host metabolism and obesity.

Poster Presentation

Investigating Odorant-Baited Traps and Miltefosine for the Control and Treatment of Chagas Disease in Belize, Central America

Robert Wozniak
College of Science
Science Preprofessional Studies and Spanish

Advisor: John Grieco, Dept. of Biological Sciences

Before landing in Belize, a Chagas endemic country, there were several unanswered questions regarding the current preventative measures used to combat this neglected tropical disease and the vectors that transmit it, the methods of treatment, and how new treatment methods could be introduced into the country via the Belize Ministry of Health. To better understand the vector populations, our research team evaluated if odorants could successfully stimulate the olfactory systems of *Triatoma dimidiata,* a Chagas vector, for improved capture efficiency. We employed odorant-baited traps and performed manual inspections of community homes in search of *T. dimidiata* (commonly known as kissing bugs) in Belize. We also investigated the repurposing of a chemotherapeutic agent, miltefosine, for use as a treatment for Chagas disease treatment and evaluated its utility against the *Trypanosoma cruzi* parasite and *T. dimidiata* vector. Wild type *T. dimidiate* were collected from various habitats across Belize and were fed miltefosine spiked blood meals via a membrane feeding system in order to generate mortality dose-response curves. The final part of the research was to determine how new drug therapies, such as miltefosine, could be introduced and implemented into the Belizean health system. Information was acquired by interviewing various health professionals, including pharmacists, physicians, and members of the Belize Ministry of Health and Department of Health Services. Results demonstrated that 1) the odorant-baited traps were ineffective at improving capture efficacy, 2) miltefosine demonstrated little success at killing the Chagas vectors, and 3) the Belize Ministry of Health does not currently have a drug registration system in place, making it difficult for new drugs to be introduced in-country. Thus, more work must be conducted to identify appropriate attractant lures and trap modalities to increase collection methods, determine if miltefosine can significantly decrease the transmission of Chagas, and aid in developing guidelines for the Belize Ministry of Health in creating effective drug legislation policies.

Poster Presentation

Drink This but Not That.....

Jonathan Yang
The Montessori Academy at Edison Lakes

According to the CDC, in 2014, 29.1 million people in the United States have diabetes. In 2007 alone, diabetes global treatment cost approximated 174 billion dollars. The hallmark of this disease is symptomatic glucose intolerance resulting in hyperglycemia. Most clinicians recommend to that diabetic patients check their blood sugar while fasting and two hours postprandial (after eating a meal). This project was designed to determine if higher sugar content in beverages would lead to higher glucose spikes and to quantify these glucose spikes. Trials were conducted “in vitro” using invertase enzyme in eleven different beverages. 15 drops of invertase enzyme solution were added to 15 mL of each beverage sample. Glucose concentration was checked in 5 minute intervals for 120 minutes. Each sample was tested twice for accuracy. The highest glucose peak recorded were: Pepsi-Cola (11.3% sugar) - 2000 mg/dL at 15 minutes, Coca-Cola -1000 mg/dL (11% sugar) at 20 minutes, orange juice (9.2% sugar) - 500 mg/dL at 15 minutes, and sweetened ice tea (7.1% sugar) - 500 mg/dL at 40 minutes. Neither Low fat 1% milk (5% sugar) nor the Glucerna Carbsteady shake (2.5% sugar) demonstrated detectable glucose concentrations. However, these two beverages contain lactose; invertase reacts specifically with sucrose. Lactase would be necessary to break down to galactose and glucose. Glucerna Carbsteady shake contain blends of slowly digestible carbohydrates such as sucromalt, isomatulose, and corn maltodextrin. These slowly digestible carbohydrate blends have been shown to cause lower glucose spikes that sucrose as well. Diet Snapple, Diet Pepsi, and VitaRain Zero contain non-nutritive sweetener (either sucralose or aspartame). The glucose reading was undetectable in those samples. These sugar substitute demonstrated to be safe to be consumed by a diabetic patient. Faygo Sparkling water and Silk Almond unsweetened milk contain zero sugar. Because glucose readings were undetectable, these beverages are deemed safe for a diabetic patient to consume as well. One limitation of this project was that only invertase enzyme was used. This enzyme could not break down the lactose present in low fat 1% milk and Glucerna Carbsteady shake. Thus, while these drinks theoretically could spike blood sugar, their effect were unmeasurable. However, in reality, many different sugars and sweeteners are used in drinks; thus, there was no way of feasibly determining which additional enzyme besides invertase should be used. Also, glucose readings reported on the test strips were subject to interpretation. Lastly, this project was conducted 'in vitro'. Ideally, this experiment would have been conducted in a living human being. However, this is not feasible because of ethical standards and the invasive nature of measuring blood sugar. Nonetheless, despite these limitations, this project provides a baseline for gauging which beverage are safe for a diabetic patient to consume. Future research should be focused in developing less invasive methods of measuring blood glucose levels. These new techniques would enable patients to make more informed food and drink choices.

Poster Presentation

Statistical Analysis of Death Records Provides Insights about Childhood Disease Epidemics in 18th Century New England

Yutong Yao
College of Science
Science Business
Magdalene Walters
College of Science
Biological Sciences
Marya Poterek
College of Science
Science Computing

Advisors: Alex Perkins, Dept. of Biological Sciences and Nicholas Bonneau, Dept. of History

Prior to the advent of mass vaccination efforts in the early 20th century, epidemics of a number of childhood diseases had strong impacts on the survival of children. In some cases, these epidemics left perceptible signatures in death records that were compiled by parishes and local communities throughout the region. The goal of our study was to identify time periods with elevated levels of mortality based on statistical analyses of demographic data that may be suggestive of local epidemics at particular points in time. Birth dates, death dates, and age at death were collected from the text records of a sampling of Massachusetts towns and processed into a database of birth and death dates on the individual level with the R programming language. Visual analysis of the data was consistent with the hypothesis of elevated mortality, particularly among children, during two time periods. These periods of possibly elevated death rates were further quantified in a calculation of childhood mortality during the periods of interest and in the development of a survival analysis that accounted for the presence of background mortality unrelated to the epidemics in question. Our study presents the statistical framework employed to consider these epidemics as well as preliminary results from its analysis.

Poster Presentation

Notre Dame Compound Curation

Eric Young
College of Science
Chemistry

Advisor: Bruce Melancon, Dept. of Chemistry and Biochemistry

The Chemical Synthesis and Drug Discovery Facility currently houses, maintains, and supports the Notre Dame Chemical Compound Collection (NDCCC), a collection of unique chemical entities discovered or procured at the University of Notre Dame. This collection, containing 20,000 substances, has been sourced from various research programs across the University. With the cooperation of the principal investigators, these compounds have been obtained and cataloged by facility staff. All compounds in the collection have been checked for purity, barcoded, and recorded following pharmaceutical industry standards. The compounds that have passed Eli Lily's Open Innovation Drug Discovery (OIDD) were sent in for further testing using their bioassays. The Warren Center is now in a unique position to leverage these collections for screening in many collaborative research programs.

Poster Presentation

Molecular species identification of mosquito samples from Democratic Republic of Congo

Xiaoyu Yu
College of Science
Biological Sciences and Mathematics

Advisor: Neil Lobo, Dept. of Biological Sciences

Malaria is an acute febrile illness caused by the Plasmodium parasites that are transmitted to people through the bite of infected female *Anopheles* mosquitoes. In the Democratic Republic of the Congo (DRC), 100% of the population is under risk for malaria infection (<1 case per 1000 population). One of the most efficient and cost-effective interventions is vector control, reducing transmission of parasites by limiting vector and human interaction (WHO 2015). Different vector control methods target mosquitoes with different behaviors, so the understanding of malaria vector species in association with their bionomic traits is key to successful intervention strategies. Molecular methods allow the correct identification of Anopheles, while morphological identification is unable to distinguish cryptic, and unknown species. Moreover, single nucleotide polymorphisms (SNPs), indicative of *Anopheles* species, cannot be detected with morphological methods. Molecular methods are not routinely used in the DRC, with less consistent morphological species identification being more prevalent – negatively impacting downstream analysis. Towards filling this knowledge gap, this project produced the first ever molecular characterization of vector species in the DRC. In the summer of 2016, 330 mosquito samples from DRC were obtained and analyzed with Polymerase Chain Reaction (PCR) for the ribosomal internal transcribed spacer region (ITS2) and mitochondrial DNA cytochrome oxidase subunit 1 (CO1). Contigs and SNP analysis were performed from which evolutionary relatedness and phylogenetic analysis was conducted. Molecular data demonstrated at least 4 new or unknown *An. coustani* complex species. In addition, bionomic characterization of the morphologically identified An. coustani complex species (*An. paludis*) from Lodia and Kapalowe demonstrated completely different behaviors in both site based on time of biting, further proving the value of molecular identification methods and calling for further analysis of mosquitoes in DRC.

Poster Presentation

Production and biological evaluation of the polyketide naphthocyclinone from the bacteria *Streptomyces arenae*

Emily Zion
College of Science
Biochemistry
Eve Granatosky
College of Science
Biochemistry

Advisor: Richard Taylor, Dept. of Chemistry and Biochemistry

Natural products have been valued for their medicinal qualities for thousands of years and have helped to form the basis of modern medicine. The term natural product is used to encompass a wide range of compounds that are derived from natural sources such as bacteria and plants. The polyketide class of natural products includes many diverse secondary metabolites produced by organisms for a survival advantage. Naphthocyclinone, one natural product produced by the bacteria *Streptomyces arenae*, is a type II, aromatic polyketide that possesses antibacterial properties. In particular, naphthocyclinone belongs to the isochromane quinone family of antibiotics, which also includes the natural products granaticin and kalafungin. The full therapeutic potential of naphthocyclinone, however, is not completely understood. In order to delve deeper into this potential drug source, we plan to extract naphthocyclinone from Streptomyces arenae and complete a full chemical characterization. Efforts will be placed into increasing the production of the natural product through the engineering of the growth media. This will be done by changing the carbon and nitrogen sources available to the bacteria. Another aspect of this project will focus on identifying analogues of naphthocyclinone produced by S. arenae under different growth conditions. This analysis will utilize methods including LCMS and HPLC for identification of the compounds. Further research will go into investigating the therapeutic properties or other medical functions of naphthocyclinone and its analogues. This investigation of naphthocyclinone could lead to potentially beneficial uses for the natural product, and will contribute to the field of research of natural products and specifically the study of polyketides.