2018 IUPUI Student Research Day

Friday | April 6 | 10–2 p.m.
Hine Hall and University Tower

Abstracts
Session 1
11am - 12pm
1. Perceptions of Innovation at IUPUI
Youngbok Hong, Richard J. Anderson III, Maria Mesche, Brendan Bow, Stephen Hamori, Pratik Rath, Amadin Agho
Visual Communication Design, IUPUI Herron School of Art
IUPUI University Innovation Fellows

“Innovation” is a buzz word across society and in higher education. However, the meaning of innovation in 2018 in comparison with past meanings is changing. Innovation also contains discipline-specific meanings according to values and contributions of disciplinary knowledge in a relationship with society through history such as technical invention in science, efficient organization and process design in business, or a creative concept of product and service experience in Design. With the aim of cultivating a culture of innovation at IUPUI, the authors approached students as the primary users of potential experiences and initiated a survey. Discussed are the findings of the survey, which the team conducted in January 26-February 14, 2018. 285 responses were collected in active public spaces around IUPUI and 162 were recorded online from students and faculty. Each student on the research team led the initial qualitative data analysis by applying their disciplinary and community perspectives to interpret meaning from the content of text data. The team identified codes, examined relational meanings among the codes, and categorized themes. Presented are the identified themes with the definitional descriptor and the selected quotes from the text data. This project was undertaken to define attitudes and the contextual meaning of innovation at IUPUI to steer future efforts to foster an innovative campus. By integrating student voices, we hope to create a more innovative campus and provide a framework by which to assist other higher education programs.

Mentor: Youngbok Hong

2. The Changing War Experience of WW1 as per Erich Maria Remarque
Gage Cook
Department of World Languages and Cultures, IU School Of Liberal Arts, IUPUI

Arguably the first truly modern war, World War I (1914-1918) mobilized more than 70 million soldiers from 32 sovereign nations and was one of the deadliest wars in all of recorded history. It engulfed every sphere of modern industry, economy, politics, and culture. Likewise, unchecked technological progress only heightened these nations’ belligerent potencies; gas attacks, artillery, and trench warfare dominated militaristic strategies and scaffolded a true war of attrition. Over a decade later, Erich Maria Remarque, a German WW1 veteran, published his groundbreaking novel, Im Westen nichts Neues (All Quiet on the Western Front, 1929), written from the perspective of a teenage German soldier. This novel serves as a historical document—not of physical events but rather of the crippling physical, psychological, and political manifestations of war. Meticulously grueling detail gives the reader true insight into the collapsing mind of Paul Bäumer, the novel’s protagonist, as he shifts motivation from nationalistic pride to basic survival at all costs. My research proposes to draw connections between the increased ambiguity and unpredictability of World War I and its heightened impacts on the human psyche. I seek to correlate how the technological developments of WWI worsened the dread, trauma, and need for dissociative coping structures for the soldiers. Likewise, I seek to explore how these new war-time circumstances set the stage for the decline of nationalistic fervor as well as the development of strengthened military comradery. I examine these characteristics through the perspectives and experiences of Paul Bäumer.

Mentor: Thorsten Carstensen, Department of World Languages and Cultures, IU School of Liberal Arts, IUPUI

3. How Autonomy & Agency Influence Self-Advocacy
Delaney Francis
Department of English, IU School of Liberal Arts

This poster will focus on the importance of autonomy and agency across the curriculum and how such influences self-advocacy. When writing across the curriculum, self-sabotage and doubt can take over a writer’s mind. By promoting autonomy and agency early on, self-advocacy can increase and positively influence a writer’s perspective. These topics take place each day with writers at the IUPUI University Writing Center. As a peer consultant, many first-hand experiences have influenced this research and these topics are observed on a daily basis. In this poster, the observations on such topics at the writing center will be presented and tangible applications will be outlined.

Mentors: Sarah Layden and Marilee Brooks-Gillies, Department of English, IU School of Liberal Arts, IUPUI
4. 3D Printing of Large Scale Ceramic Components

Kassie Woodworth, Stephanie Williams, Lesley Baker
Herron School of Art and Design

Introduction: We are building a large scale 3D printer that will extrude ceramic material. This system will be able to extrude various clay body strengths and create larger products than the common Delta style 3D printer. Unique sculptural forms will be created with this printer that will then be fired in a kiln. Objective: Our six-foot-tall Delta 3D printer will be able to print larger scale products, more precise and higher quality prints, have less vibration at the base, and will be able to print more intricate forms. Methodology/Approach: Experiments were tested on the smaller, three foot, Delta printer that we already had made. We tested a hose extrusion system with a 3D part that we designed. Results: The overall outcome of our project is a solid, aesthetically pleasing design that has improved user interface, reduced the amount of handmade parts, improves the protection of motors and touch screen. The large scale will allow us to create larger forms than our original three foot design. Conclusion: The outcome of what we have created will benefit Herron School of Art and Design students and other departments throughout IUPUI.

Mentor: Lesley Baker

5. Private Equity and Its Effects on Retailers

Jacey Stuckey
Kelley School of Business

This research seeks to determine if the degree to which the amount of debt has contributed to popular retailers, such as Toys R Us, Circuit City, and HHI Gregg, filing for bankruptcy after being acquired by private equity firms. Their financial statements show the issue is more than consumer loss. Top performing private equity firms believe they have the capability to turnaround failing companies. In buyouts, private equity companies acquire companies with debt and equity to increase returns for their investors. To determine the reasons these firms filed for bankruptcy, analysis of the financial statements for 2010-2015 established growth patterns and identified significant changes. This was evaluated by changes in financial ratios like the profit margin, net income, debt to equity, current ratio, debt ratio, and return on equity. Private equity companies are known for using large amounts of debt in acquisition, which can be both helpful and harmful. Of the companies acquired, their workforces were downsized, meaning layoffs, changes in employee benefits, and total store closure. With the massive amounts of debt accumulated through operations, financing, and the initial buyout, companies struggled with their debt repayments, in addition to their other obligations. Thus, filing for bankruptcy, and in some cases, closing operations was the best decision for these once profitable and popular retailers. In the alternative investment industry, top executives at top firms have concluded, in my research period, companies were often valued too high, causing poor decision making in the acquisition process.

Mentor: Peggy Daniels Lee


Tyler Donaldson1,2, Grant Fore1, and Justin Hess1
1Stem Education Innovation and Research Institute, IUPUI, 2Department of Applied Anthropology, IU School of Liberal Arts

This systematic literature review explores the application of situated learning theory, developed by Jean Lave and Etienne Wenger, in geoscience literature. The objective of the literature review is to show how situated learning theory has been applied in post-secondary geoscience curricula across the United States, as evident through the synthesis of published literature in top-ranked geoscience education-related journals. This study analyzes articles obtained from four top-ranked geoscience education-related journals. A coding framework was developed both deductively from the core tenants of situated learning and inductively based on how articles had applied the framework in situ. Collectively, this study identifies how situated learning theory has been implemented, including alignment to the theory as defined by Lave and Wenger. Results indicate there is a limited body of knowledge on situated learning theory within post-secondary geosciences. We hope that this study will help improve post-secondary geoscience curriculum and student’s geoscience experience.

Mentor: Grant Fore, Stem Education Innovation and Research Institute, IUPUI and Justin Hess, Stem Education Innovation and Research Institute, IUPUI
An Education Futures Forum held during the 2017 Alliance for Massage Therapy Education's Educational Congress systematically gathered massage education stakeholders’ opinions through a World Café modeled exercise. Forum attendees participated in three, concurrent 30-minute breakout group sessions in adjacent rooms focused on Continuing Education, Schools, or Employment. During each session, participants rotated between four tables asking what should be done more, differently, stopped, and started in massage education related to that room’s focus. Participants wrote their per-table prompt responses on large post-it sheets. Responses were reviewed by respective breakout sessions’ participants who awarded importance points with 6 blue and 3 orange dots each worth 1 and 3 points, respectively. Post-it sheet responses and point allocations were transcribed into an Excel spreadsheet and analyzed for descriptive statistics and top scoring comments from each room. 85–91 attendees participated in the three breakout sessions resulting in 674 comments with 3744 assigned value points. The top 5 scoring comments from each room per session (N=45) determined stakeholder’s most critical views. Stop comments made up the smallest total comments proportion (19%) yet largest top scoring comment proportion (36%) potentially highlighting unified frustration for various massage education practices. Comparatively, Start comments made up 26% of total comments but the smallest highest scoring proportion (18%) perhaps suggesting stakeholders feel it more important to improve what is already being done rather than beginning new endeavors in these areas. Stakeholder views were systematically gathered in a large conference setting for organization, analysis, and dissemination to inform field decision making.

Section 5: Research Project Mentor or Advisor

Diane Mastnardo2, BS, LMT, Niki Munk1, PhD, LMT

8. Transferrable skills gained from experience as a peer-leader in a PLTL program: reflections, applications, and long-term impacts on professional lives

Prathima Lakmal, Ph.D., Anusha R. Rao, Ph.D., Pratibha Varma-Nelson, Ph.D.
Health Informatics, STEM Education Innovation and Research Institute.

Peer-led team learning has proven to be a great way to enhance the skills of workshop peer leaders in a multitude of academic programs. Their role as a peer leader have improved their leadership and management skills, increased content knowledge, personal growth through increase in the confidence and motivation as well as others. Skills such as these generally follow students through the rest of their career. These peer leader experiences have influenced them to put it on their LinkedIn Profile. This demonstrates the potential benefit of these types of experiences. This study examines the transferable skills that the peer leaders might have acquired through their PLTL experience. The participants were selected by data mining the LinkedIn portal and selecting participants with PLTL peer leader experience in the past 10 years. Semi-structured interviews were conducted with the participants who were from diverse backgrounds such as varying universities, disciplines, ages and years since being a peer leader. Thematic analysis of these interviews showed that some of the skills like leadership, self-confidence, coping with challenges and decision making skills were relevant to their workplace today. The results obtained from the qualitative analysis indicates the value of being a peer leader and its impact on one’s career. A quantitative survey instrument will be developed to emphasize on the further results.

Mentor: Pratibha Varma-Nelson, Ph.D.

9. International Students Adaptation Process in Midwestern Urban School of Engineering and Technology

Agnieszka Piekarzewska2, Gulzhahan Oraz1
1 Department of Computer Information & Graphics Technology (CIGT), School of Engineering and Technology
2 Department of Technology Leadership and Communication (TLC), School of Engineering and Technology

Adapting to their new educational environment is important for success of all students, especially international students. While considerable work has been done investigating this, little has been done with a specific focus on students in Engineering and Technology programs. This research explores the cultural, academic and social adaptation experience of international students in a midwestern urban School of Engineering and Technology. Specifically, it addresses the difference in the adaptation process depending on world region of origin, English proficiency, and satisfaction with institutional support on the campus. Emails were sent to 605 international undergraduate and graduate students school email address requesting they take an online survey (administered in Qualtrics). Between 12 December 2017 and 31 January 2018, 102 students responded to the survey. Most of the respondents originated from the Eastern cultures (India), describing their English proficiency level as high. Additionally, graduate students tended to adapt faster and smoother than undergraduate.

Mentor: Dr. Brandon Sorge, Department of Technology Leadership and Communication (TLC), School of Engineering and Technology
Burnout, which is defined as increased levels of emotional exhaustion and depersonalization and decreased level of personal accomplishment, affects a physician's personal and professional life tremendously. Rates of burnout among physicians are extremely high. The literature suggests but has little evidence in support that empathy has a mitigating effect on burnout, which we used as a premise for our project. Most evaluation of burnout has been of physicians, but research suggests that burnout begins as early as undergraduate years and especially within medical school. 53 medical students from all four years of medical school (24 male and 29 females) were surveyed using two scales that measured burnout levels and empathic abilities respectively. Analysis indicated that medical students scored moderate on emotional exhaustion (M=24.71, SD = 9.65), low on depersonalization (M= 4.96, SD = 4.73), and high on personal accomplishment (M= 29.88, SD = 7.68), suggesting that many are not experiencing high levels of burnout. Students were above average on empathy (M= 109.08 SD = 8.16). Part of the hypothesis was supported. Regression results indicated that empathy scores explained 16.1% of the variance (R²=.161), F(1,50)=9.61, p<.01) and significantly predicted depersonalization (β = -.23, p<.01). This makes intuitive sense as providers who are more empathic are typically more personally invested in their profession. Future research should investigate what other factors influence burnout.

Mentors: Maria Brann, Department of Communication Studies, IUPUI School of Liberal Arts

11. The relationship between parental abandonment and depression diagnosingirls that are victims of commercial sexual exploitation

Peyton A. Carroll, Alexandra R. Hershberger, Melissa A. Cyders
Department of Psychology, Purdue School of Science, IUPUI
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Introduction: Girls that are victims of child commercial sexual exploitation (CSEC) have highrates of depression diagnoses. The current study sought to understand how different adverse childhood experiencesare related to depression among CSEC victims. Methods: Data were collected from comprehensive psychological assessment reports of 42girls that were victims of CSEC (mean age = 15.62, SD = 1.01, 40 % White, 37.1% Black). Girls self-reported types of stressful life events they hadexperienced and licensed clinicians made depression diagnoses based on the full assessment. Results: We conducted abinary logistic regression; the dependent variable was depression and the independent variables were abandonment by a parent, witnessing domestic violence, death of a loved one, being bullied, and witnessing gun violence. Results indicated that only abandonment by a parent was significantly related to greater odds of the girl being diagnosed with depression(OR= 4.385, p= .02, 95% CI 1.072 to 17.941). Discussion: CSEC victims that have been abandoned by a parent have almost 4.5 greater odds of being diagnosed with depression compared to those that have not been abandoned by a parent. Abandonment by a parent mayserve asan important risk indicatorof later depression among girls who have been victims of CSEC.

Mentors: Alexandra R. Hershberger, Department of Psychology, Purdue School of Science, IUPUI; Melissa A. Cyders, Department of Psychology, Purdue School of Science, IUPUI

12. Ryan White: A Geospatial Analysis of his Correspondence

Haley Hoernschemeyer
Geography –IUPUI School of Liberal Arts

The letters Ryan White received over the course of his diagnosis, illness, and eventual death show a spatial distribution that reflected the United States' response to the AIDS epidemic. Ryan was diagnosed in December of 1984 at the height of the AIDS epidemic, and the panic that surrounded it. In 2000, the Children's Museum of Indianapolis accessioned a selection of letters sent to Ryan White from 1989 to 1990. The expanded incorporation of these letters into the museum's “Power of Children” gallery will introduce museum visitors to Ryan and broaden the understanding of how he played a role in developing the public perception and awareness of AIDS in the 1980's. Ryan was one of the first children in the United States to go public with his AIDS diagnosis, which sparked a strong reaction among people of all age groups throughout the United States. Ryan's correspondence and the outpouring of support he received gives us insight into the multifaceted reaction to the AIDS crisis, especially from young people. Before Ryan became associated with the AIDS epidemic, this disease was seen primarily as an urban, gay, and drug-user related issue. The goal of this research is to gain further understanding of societies shifting response to AIDS during the 1980's, by placing these letters in their social and geographic context.

Mentor: Owen Dwyer
13. Anxiety and Alcohol Use in E-Cigarette Users: The Mediating Role of Positive Alcohol Expectancies

Allison Kirby1, Alexandra Hershberger1, Melissa A. Cyders1

1Department of Psychology, IUPUI School of Science

Anxiety is a risk factor for alcohol use, which may in part be due to individuals with anxiety having positive expectancies of alcohol use (e.g. "alcohol use makes me feel more calm"), which fuels alcohol use. E-cigarette users have been identified as a group at risk for alcohol use. Thus, identifying if anxiety contributes to alcohol use through positive alcohol expectancies in this population is important for developing appropriate alcohol risk and intervention models. The present study examined the relationship between anxiety and alcohol use through positive alcohol expectancies in a group of 25 community-dwelling e-cigarette users (mean age=30.32, SD=12.27, 52% White, 68% male). We conducted a mediation model with anxiety as the independent variable, alcohol use as the outcome variable, and alcohol expectancies as the mediator, controlling for age and gender. Although the model was not statistically significant (Indirect effect=0.11, 95% CI -0.07 to 0.32, Normal theory tests for indirect effect p=0.25), the effect of anxiety on alcohol use through alcohol expectancies was medium in magnitude (d=0.50), which suggests the potential of examining this effect in a larger, more properly powered sample. Overall, among e-cigarette users, there is a medium effect of anxiety on alcohol use through positive expectancies of alcohol use. Although the data are cross-sectional, limiting directional inferences, it is viable to explore how targeting and changing modifiable alcohol expectancies in e-cigarette users might reduce anxiety-associated alcohol use. Section

Mentor: Melissa A. Cyders, Department of Psychology, IUPUI School of Science

14. Identifying Key Challenges and Opportunities in Food Support Through Observation and Interviews

Jiva Capulong

Informatics/Human-Computer Interaction, School of Informatics and Computing; Indiana University–Purdue University Indianapolis

Food insecurity is a prevalent issue in America, where 1 in every 10 people struggle to regularly obtain healthy and affordable food. Prior research shows that it is often an issue that persists throughout one's life, and can be a heavy burden on the educational pursuits of college students. In this study, we seek to identify challenges and opportunities in the mission of providing food support for college students to identify key design strategies for potential technological intervention. We will be conducting a study over the spring 2018 semester where we will collect qualitative data through observational study and interviews with Paw's Pantry, a campus-wide food support organization of IUPUI. 12 hours of volunteering were done at the pantry were done to observe the typical shift of a volunteer. Additionally, 5 out of 10 interviews have currently been conducted with individuals involved with Paws, to collect further information on the operations of a campus-wide food support organization. Early analysis suggests that challenges included limitation of resources, communication with other departments, tedious processing of customer data, and the pantry's limited space. Opportunities include more sophisticated inventory equipment, promoting awareness of the pantry, and promoting good health and cooking. Future steps to take include interviewing other campus food organizations, such as Campus Kitchen. We will also begin conceptualizing technology designs for addressing the challenges from our findings. This would be followed up with design concept validations with Paws Pantry and its customers to further improve and develop additional iterations.

Mentor: Lynn Dombrowski, Human-Centered Computing Department Indiana University–Purdue University Indianapolis
15. mHBS powered by DHIS2: Neonatal Device Prototyping and Educational App Development to Support Targeted Neonatal Training Initiatives among Healthcare Workers in Low and Middle-Income Countries

Elisabeth Meyers,1 Mia Bartlett,2 Jorian Brown,2 Jonathon Bruer2 Dr. Sherri Bucher,3 Professor William Combs,2 Dr. Saptarshi Purkayastha

Introduction: Globally, an estimated 15 million infants are born too early or small, and one million of these babies die each year. Asphyxia (breathing difficulties) and neonatal hypothermia (body temperature instability) are life-threatening conditions contributing significantly to infant deaths in low/middle-income countries (LMICS). To address this, two innovative prototypes were integrated– mobile Helping Babies Survive (mHBS), an open-source Android app that we developed to improve health worker training, and NeoWarm, a biomedical device to manage and detect birth asphyxia and hypothermia. Informatics objectives included development and integration of DHIS2/mHBS for health worker tracking as they (a) trained in resuscitation and (b) applied thermal support for neonatal hypothermia prevention.

Methods: First, multidisciplinary student teams performed literature reviews to map health tools (e.g., checklists), and wearable/wireless sensors for vital sign and hypothermia monitoring. Independently, each team evaluated design challenges, followed by collective problem-solving towards refinement of the mHBS and NeoWarm prototypes. During phase two, the informatics team used scrum methodology, and GitHub for development.

Results: A linked, open-source digital health tool, mHBS/DHIS2 was created. Specifically, the DHIS2 Tracker function: (1) enabled follow-up of health workers who received training; (2) provided linkages, for these health workers to educational videos and PDF training materials. On-going efforts include function development whereby the mHBS/DHIS2 app allows continuous monitoring of babies wearing the NeoWarm device.

Conclusion: The mHBS/DHIS2 app is an integrated training tool for healthcare workers in LMICs. Combined with NeoWarm, mHBS/DHIS2 aims to assist healthcare workers in effectively monitoring, and managing, the care of newborn babies.

16. Redesign of snowmobile to reduce emissions and noise levels

Swapnil Pravin Bansode, Michael Golub, Jing Zhang

Department of Mechanical and Energy Engineering, School of Engineering and Technology

The main objective of this project is to redesign and modify a snowmobile to reduce emissions and noise levels. It will also reduce emissions, making it environment friendly in all aspects and high performance. Innovations for this project include: two-stroke oil analysis; ECU remapping; and three-way catalytic converter. A Polaris Axs Switchback Assault 144 with 800 cc engine was used. Exhaust system was remodified by using three-way catalytic convertor and flow-master exhaust. The snowmobile was tested using HPC501 emission analyzer and Dyno-mite for performance testing. It was observed that with modification of exhaust and remapping of ECU using Dyno-jet Power Commander V, emission levels and noise levels were reduced as compared to the stock.

Mentor: Jing Zhang

17. Recycled and Household Plastic Suitability for Reuse via 3D Printing

Tanjimul Alam, Carolina Cardona, Dante Goss, Nicholas Lozier, Julian Strobel

Mechanical Engineering, Purdue School of Engineering and Technology

As an increasingly widespread, affordable, and creatively applied 3D printing plastic usage market meets current day's extensive household/commercial plastic availability, the opportunity to recycle/reuse these widely accessible materials is a promising one. If viable, utilizing commonplace plastics at the local and household level through 3D printing may have a number of cost saving, waste reduction, and distributed/decentralized manufacturing implications. At IUPUI, the research via the MURI suitability project in this field takes the form of collecting, shredding, injection molding, extruding (forming material into a cord-like filament used in 3D printers), FDM 3D printing (successively laying down layers of melted filament material to form parts), and testing various attempted plastics. Testing has consisted of informal/formal melt, extrusion, and molding attempt tests and performance (tensile strength) comparisons between experimental and common AM industry materials are also to be done. Preliminary results have shown certain plastics, such as #2-HDPE and #5-Polylpropylene, to be more moldable/extrudable/printable than less viable plastics such as #1-Polyethylene Terephthalate and #6-Polystyrene.

Mentor: Andres Tovar and Amanda Siegel
User feedback is one of the unique aspects of app stores. Users can effortlessly leave reviews and ratings for an app, and these reviews are as valuable as other traditional feedback mechanisms (e.g., code analysis). A feedback could be positive, negative, or neutral. Unfortunately, the user feedback is often influenced and does not reflect the actual functionality/usability of an app. As there are many apps offering similar functionality, the problem of selecting a particular app for a task is manual, laborious, and often time-consuming. To address these challenges associated with selection and ordering of apps, it is necessary to devise comprehensive and holistic approaches that can help to reason about the total behavior of an app. Therefore, in our research, we are developing a trust-based rating and ranking (TRR) approach that relies on evidence associated with an app's internal view and external view. The internal view represents the programmatic artifacts (e.g., system source code) and the external view represents the user-provided feedback (such as reviews, rating, etc.). Based on the both views, we compute the trust tuple (made up of Belief, Disbelief, and Uncertainty) for each app and according to the trust values order apps offering similar functionality. Apps used for empirically evaluating the TRR approach are collected from the Google Play Store. Our experiments compare the TRR ranking with the user review-based ranking present in the Google Play Store. Our initial results have led to insights that are deeper than the superficial star ratings provided by most app stores.

Section 3: Author Department and School Affiliation

Mentor: Rajeev Raje, Department of Computer & Information Science, School of Science, IUPUI

18. TRR: Trust-based Mobile Apps selection and ordering over traditional feedback mechanism

Nahida Sultana Chowdhury1, Rajeev Raje1
1Department of Computer & Information Science, School of Science, IUPUI


Harshal Dhamade, Nishant Hawaldar, Jing Zhang
Mechanical and Energy Engineering Department, IUPUI, Indianapolis

The extrusion-based 3D printing process extrudes metal-based binder systems, forming the desired component layer by layer. For this project, we will be designing a warm metal extruder to heat and extrude a water atomized stainless steel powder (17-4 PH) slurry. An existing extruder for injection 3D printing is taken as a reference and with dimensions matching the outer diameter of a plunger, and the warm metal extruder is modified. For the stainless steel slurry, ongoing research involves making of a binder system consisting of paraffin wax, polyethylene, and stearic acid. The feedstock will be loaded into a heated extrusion chamber, which will be mounted on a xyz table which is controlled by the computer system. The extruded 17-4 PH stainless steel samples will be examined for mechanical properties such as tensile strength, hardness, and toughness. Extruded samples will be sintered later and examined to check any changes in mechanical properties and molecular structure.

Mentor: Dr. Jing Zhang

20. A Residential Energy Management Unit

Nick Pohlman1, Ryan Snow2, Abolee Diwate3, Joshua Potts3, 4Chandler Oakes,1 Afshin Izadian, and1 Robert Weissbach
1Department of Engineering Technology, Purdue School of Engineering and Technology, IUPUI; 2IUPUI; 2Department of Mechanical Engineering and Energy, Purdue School of Engineering and Technology; 3Department of Electrical and Computer Engineering, Purdue School of Engineering and Technology; 4Kelly School of Business

The purpose of this research is to construct an energy management unit including a low-voltage level inverter with bidirectional DC charger circuits and the program the energy management control unit to monitor energy usage and state of charge of an energy storage to reduce electric bill costs in for a residential load. Some utility providers in America use a peak and off-peak hour billing system. Peak hours are declared when demand for electricity threatens to outpace supply, which typically occurs during hot summer days and cold winter mornings. This leads to an increase in the electricity bill. This project designed a local energy storage unit that a consumer can use in their own home. The unit can be received through the mail and compatible with residential power outlets. This inverter unit is designed to charge during the off-peak hours and discharge during peak hours, ultimately saving the consumer money. In the research, there are 3 major data types that were used: 1) Household power usage data (collected through surveys) to determine design constraints 2) Economic data (includes cost of power, parts) to determine budget constraints 3) Data from Devices (Obtained through lab testing, measuring voltage and current to analyze power output and quality). These helped provide the necessary groundwork for the project. The outcome of this project is to deliver an working prototype of an inverter that will work towards innovating energy storage and provide consumers with a cost-saving, renewable energy device.

Mentor: Afshin Izadian, Department of Engineering Technology, Electrical and Computer Engineering, Purdue School of Engineering and Technology, IUPUI; Robert Weissbach, Department of Engineering Technology, Purdue School of Engineering and Technology, IUPUI
21. Study of dimensional accuracy and printing parameters in 3D printed PLA
Tejesh Dube, Nishant Hawaldar, Piyush Pai Raikar, Jing Zhang
Department of Mechanical and Energy Engineering, School of Engineering and Technology

In this work, 3D printed part of PLA was checked for dimensional accuracy and printing parameters were optimize for getting optimal design. For doing so we selected nozzle temperature and step size as printing parameters for optimization. Design of Experiment (DOE) was done using Minitab to check optimal parameters. We concluded that increasing the nozzle temperature increases the dimensional accuracy of the printed part, and decreasing the step size of will increase the dimensional accuracy.

Mentor: Jing Zhang

22. Assessment of Mixed Reality Virtual Environment for STEM Learning
John Grove, Mauricio Ambrosio, Mounir Karmada
Department of electrical and computer engineering, 2Department of mechanical engineering, Department of Computer Information and Graphics Technology, Purdue School of Engineering and Technology; Indiana

This research project the development of an augmented reality system using the Microsoft HoloLens with inputs simulated using a Fadal CNC multiprocessor controller. There were several problems during the process of connecting the CNC controller machine and the computer. After several trials, we were able to connect the CNC controller with the computer by using RS232 to RS232 cable and RS232 port PCI card. However, the data we received was unusable. This lead us to another possible input solution. We could create our own Bluetooth keyboard using the existing Fadal multiprocessor and connect it directly to the HoloLens for proper muscle memory CNC training. The other part of the project involves porting an existing Oculus Rift Unity environment and optimizing the experience for use with HoloLens. This part of the project is still active and poses many hurdles including things like outdated scripts and HoloLens hardware glitches. HoloLens development is still young and therefore some experimentation is necessary to solve problems within Unity. Currently we have a real size Fadal CNC machine hologram with a ray cast cursor in the Unity environment. The ultimate goal of this research is to have a functional app using the HoloLens so we can determine if this new technology is a viable way to conduct STEM training. We will do this by conducting usability studies with real a real cnc machine, Oculus, and the HoloLens.

Mentor: Jesse Satterwhite, Christian Rogers, Dr. Hazim El-Mounayri

23. 3D printing of molecular sieve zeolites 13X, 5A, 4A and 3A monoliths
Nishant Hawaldar, Jing Zhang
Department of Mechanical and Energy Engineering, School of Engineering and Technology

Extrusion based freeform fabrication technique for 3D printing is one of the emerging additive manufacturing technology used for printing range of materials from metal to ceramics. In this study, we will print samples of different molecular sieve zeolite monoliths like 3A, 4A, 5A and 13X which are generally used in the applications where gas adsorption is required. Doing so we will develop slurry of zeolite powder added with binders and extruded it through unassembled and configured extrusion based 3D printer developed for our previous research work. The 3D printed zeolite samples will be then sintered to achieve better mechanical strength. The physical and structural properties of 3D printed zeolite before and after sintering will be characterized along with the gas adsorption performance of zeolite. The Brunauer–Emmett–Teller (BET) test of 3D printed samples will be performed for calculation of the surface area, which will give us the capacity of gas absorption into 3D printed zeolite.

Mentor: Jing Zhang
24. Nanoscale Transfer Printing of Plasmonic Structures

Xiang E. Huang1, Jong E. Ryu 2

1 Department of Electrical and Computer Engineering, Purdue School of Engineering and Technology; 2 Department of Mechanical Engineering, Purdue School of Engineering and Technology

The topic of this research is nanoscale transfer printing (nTP) of plasmonic structures. The objective is to develop a nTP method that will successfully transfer the gold gratings from silicone master mold plasmonic structures to sulfur substrate with high percentage yield. The MHA silicone master mold is first fabricated using E-Beam lithography and undergo hydrophobic treatment. Then, master mold is replicated by double casting with PDMS to create nTP stamp. Gold and Titanium is deposited to the nTP stamp. The gold deposited nTP stamp and sulfur substrate then undergo O2 plasma treatment. Lastly, nTP stamp is placed on top of sulfur substrate and a heat press is used to transfer the plasmonic structures from the nTP stamp over to the sulfur substrate. By setting the temperature to 50°C, applying pressure of 10kPa, O2 plasma time of 10 minutes and printing time of 10 minutes, the transfer of plasmonic structures is above 95% percentage yield. The plasmonic structures transferred to sulfur substrate is then observed using Scanning Electron Microscope (SEM). The desired pitch, width and height of the plasmonic structure is preserved after nTP. This research will help to speed up the process of nanoscale plasmonic structures fabrication. It takes a shorter time, involves less equipment and requires lower cost compare to Reactive Ion Etching (RIE).

Mentor: Jong E. Ryu, Department of Mechanical Engineering, Purdue School of Engineering, IUPUI

25. 3D Printing of Ceramics: Zircon

Piyush Pai Raikar, Dr. Jing Zhang

Department of Mechanical and Energy Engineering, School of Engineering and Technology

The aim of this work is to develop a methodology to 3D print of zircon (zirconium silicate) for casting molds. Zircon is a high temperature ceramic and hence is an ideal choice for the desired application due to its high thermal resistance. Zircon powder along with a binder and water is used in order to prepare the slurry for 3D printing. An extrusion based 3D printer is assembled and configured to print using the zircon slurry. Sintering is performed on the printed parts that are in green state. The physical and mechanical properties of the 3D printed zircon parts for different configurations are obtained and the 3D printing process is optimized. Additionally, a computational fluid mechanics (CFD) based model is developed to simulate the 3D printing process, and correlate with experimental observations.

Mentor: Dr. Jing Zhang

26. W-C-DASH: A Service-based Decentralized Prediction System of Social Harm Events

Saurabh Pandey, Nahida Chowdhury, Milan Patil

Computer and Information Sciences, School of Science

Social harm events including crime, forgery and drug abuse severely impact our society. As per records, total cost associated with these events is fairly high. Thus, there is a need for software system capable of analyzing such reported events and forecasting the possibilities of their future occurrences. Such systems would assist the crime-fighting resources in mitigating as well as dealing with social harms in better ways. CDASH (Community Data Analytics for Social Harm) is an ongoing collaborative effort between the Indiana University-Purdue University Indianapolis (IUPUI), the Indianapolis Metropolitan Police Department (IMPD) and the Indianapolis Emergency Medical Services (IEMS) supported by the National Science Foundation (NSF). It aims to harness the power of available social harm data, predictive analysis based on point processes, and principles of service-oriented systems to suggest possible hotspots for incidences in the Indianapolis metro area. In this research, a preliminary prototype for CDASH, called Web-C-DASH (W-C-DASH) is presented. It allows users to report live social harm events using web browsers as well as Android devices. This information is then passed to the Point Process-based service using a queuing mechanism to analyze and predict hot-spot events. Current focus is on developing a Trust-based service along with allowing a Role-based access to enhance the efficiency and usability of the system. To empirically validate W-C-DASH, we ran experiments and analyzed the results using past social harm data provided by the IMPD. The outcomes of these experiments indicate the power of predictive analyses for social harm events.

Mentor: Dr. Rajeev Raje–Computer and Information Sciences, School of Science; Dr. George Mohler–Computer and Information Sciences, School of Science; Dr. Jeremy Carter–SPEA.
27. Distributed Cyberbullying Detection System

Rohit Pawar, Yash Agrawal, Akshay Joshi
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Due to the proliferation of online networking, friendships and relationships, social communications have reached a whole new level and we are observing its undesirable behaviors. One such undesirable behavior is cyberbullying. One definition of cyberbullying is: “Cyberbullying is when someone repeatedly makes fun of another person online or repeatedly picks on another person through e-mail or text messages or when someone posts something online about another person that they don’t like.” Cyberbullying can have damaging physical and mental effects on the victims and hence, it needs to be tackled efficiently. To encounter this problem, we have designed a distributed cyberbullying detection system that will detect bullying messages in real time and drop them before they are sent to the intended receiver. A prototype has been created using the principles of NLP, Machine Learning and Distributed Systems. Preliminary studies conducted with it, indicate a strong promise of our approach.

Mentor: Dr. Rajeev R. Raje

28. Creep Modeling of 3D Printed Metals

Vighnesh Shetty, Dr. Jing Zhang
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Creep properties are critical for metals used in high temperature environment. In this work, a finite element based model is developed for modeling the creep behaviors of 3D printed nickel based super alloy Inconel 718. A user-defined creep subroutine is formulated for accurately capture creep mechanisms in the alloy. Additionally, a MATLAB code is also formulated to predict the strain rate of the alloy under a certain temperature. This research consists of creating a subroutine for creep environment for 3D printed metal components, to be compared with commercially wrought metal components. Creep model for a well-known nickel based super alloy Inconel 718 (IN718) used in aeronautic applications is constructed. Data was obtained under annealing (1 hour at 1750°F – 1800°F) and aging treatments. MATLAB is used to fit the curves formed by the data obtained by analysis using the subroutine data model, at the same time a MATLAB creep prediction implementation is being formulated to generate a plot of data points predicting strain rate of a given material under a certain temperature.

Mentor: Jing Zhang

29. Additive manufacturing of polymer derived ceramics

Xuehui Yang, Jing Zhang
Department of Mechanical and Energy Engineering, School of Engineering and Technology

Polymer derived ceramic (PDC) provides a novel additive manufacturing approach to produce complex ceramic components. In this work, preceramic resin (mercaptomethyl) methylsiloxane with vinylmethoxysiloxane was used to produce several PDCs with suitable photoinitiator and photoabsorber. The resin was printed by an SLA 3D printer and was then pyrolyzed in a furnace. Blending of the polymers, exposure time and sintering conditions were studied to optimize the additive manufacturing process and properties. The PDCs demonstrate a high geometric accuracy in a variety of forms, including cube, honeycomb and different patterns.

Mentor: Jing Zhang

30. Prediction of grain structure of laser powder fused metal using combined CFD and CA approach

Yi Zhang, Jing Zhang
Department of Mechanical and Energy Engineering, School of Engineering and Technology

Laser powder bed fusion (L-PBF) is a typical additive manufacturing technique that uses laser to selectively melt metal powder layer by layer to form an object. The grain structure of L-PBF part can be columnar or equiaxed, depending on not only the laser scanning conditions (laser power, scan speed), but also the thermal properties of the metallic material. In this work, the grain structure of stainless steel under L-PBF is predicted using computational modeling method. The method involves a CFD modeling of powder melting and a CA modeling of grain growth during molten metal silicification. Further, the effect of varying laser scan speed on grain structure is discussed.

Mentor: Jing Zhang
31. Polymer Composite Materials for Flexible Electronics
Alyssa R. King1, Brandon T. Watson2, Gabrielle A. Skwarcan3
1Department of Neuroscience, Purdue School of Science; 2Department of Mechanical Engineering, Purdue School of Engineering and Technology; 3Department of Biomedical Engineering; Purdue School of Engineering and Technology

Polymer composite materials have many different applications when it comes to flexible electronics, including supercapacitors, stretchable solar cells, strain gauges, conductors, and many others. New polymer composite materials can create more flexible and conductive components when compared to other used materials. To further explore this topic, research on many different types of polymer composite materials, characterizations, syntheses, and applications was completed. Polymer composites are made from a combination of a reinforcement fibers and a polymer matrix. Commonly used reinforcement fibers are graphene, carbon nanotubes (CNT), or silver nanowires (AgNW) and commonly used polymer matrices are poly(methyl methacrylate) (PMMA), polydimethylsiloxane (PDMS), polyurethane, or polyethylene (PE). These polymer composites are synthesized using chemical vapor deposition, spin-casting, or chemical synthesis. These polymer composite materials are characterized by a variety of devices, including scanning electron microscopes, transmission electron microscopes, mechanical testers, Raman spectroscopy, cyclic voltammetry, or conductance testers. Compiling all of this information provides one common source that can be used to categorize the review paper by materials, synthesis, characterization, and application. This will be beneficial for further research involving polymer composite materials for flexible electronics.

Mentor: Jong Eun Ryu, Department of Mechanical Engineering, Purdue School of Engineering and Technology, IUPUI

32. Fabrication and Characterization of Nano-Scale Magnetic Materials
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1Department of Physics, IUPUI School of Science.

This paper describes the processes for fabrication and characterization of magnetic thin films. The scanning tunneling microscopy (STM) tips were chemically etched for use of characterization. Magnetic thin films were prepared using magnetron sputtering followed by post annealing in order to create good crystalline structures of the sample. Different post annealing temperatures were tested on thin films that were then examined using the x-ray diffractometer (XRD) for the best crystalline structure; and XRD data will be presented. On the other hand, we prepared STM tip for future high quality study of sample properties. Here, different etching voltages and currents were tested for the electrochemical etching of STM tips. STM tips were examined under an optical microscope and a high resolution scanning electron microscope. The thin films have a better crystalline structure when annealed at 700 degree of temperature. The STM tips are much sharper when etched at a lower voltage, which results in slower etching. Getting reproducibly good thin films and STM tips are critical for further study. A good crystalline structure affects the magnetism of some elements allowing for different magnetic moments to be observed, and the sharpness of the STM tips directly affects the clarity of the picture of a surface scanned on the STM. This increases the reliability of getting solid results from experiments.

Mentor: Ruihua Cheng, Department of Physics, IUPUI School of Science

33. Are Vitamin E and PUFA Driven Together By Cholesterol? Computer Simulation Studies
Samuel W. Canner, Xiaoling Lengc, Fangqiang Zhua, Stephen R. Wassalla.a
Department of Physics, Indiana University-Purdue University Indianapolis, Indianapolis, IN, USA.
bDepartment of Computer Science, Indiana University-Purdue University Indianapolis, Indianapolis, IN, USA.
cDepartment of Chemistry and BioChemistry, Florida State University, Tallahassee, FL, USA.

Vitamin E (α-tocopherol) is an essential micronutrient that is incorporated into cell membranes where it is believed to protect PUFA (polyunsaturated fatty acids) from oxidation. Since α-tocopherol is in low concentration in cell membranes, generally less than 0.1 mol%, close proximity with PUFA-containing phospholipids would be advantageous to protect them from oxidative damage. We hypothesize that cholesterol, which is ubiquitous in the plasma membrane of mammals and has preferential affinity for saturated lipids, drives α-tocopherol and PUFA-containing phospholipids together. We performed computer simulations to investigate this hypothesis. All-atom, umbrella sampling molecular dynamics (MD) simulations that were run on bilayers composed of SOPC, a common bulk lipid, and SOPC with cholesterol (50 mol%) demonstrate that the presence of cholesterol reduces membrane affinity for α-tocopherol. With the use of coarse graining (CG) methods, a model of α-tocopherol was created to mimic the physical properties of the molecule. This model was then employed in CG simulations on a bilayer composed of α-tocopherol mixed with SM (a highly saturated lipid), cholesterol, and polyunsaturated PDPC (a PUFA containing lipid) that separates into SM-rich/cholesterol-rich and PDPC-rich/cholesterol-poor domains. The results of these studies that indicate vitamin E collects at the boundary between domains will be presented and discussed.

Mentor: Dr. Stephen R. Wassall, Department of Physics, School of Science, IUPUI
34. Detection and Monitoring of Compounds used in Drug Facilitated Sexual Assaults

Kymeri E. Davis1, John V. Goodpaster1

Department of Chemistry and Chemical Biology, Indiana University-Purdue University Indianapolis

γ-Hydroxybutyric acid (GHB) is a compound that can be found in cases of drug facilitated sexual assault (DFSA). GHB is an ideal drug for DFSA because it causes sedation and short-term memory loss. The detection of exogenous GHB is difficult to detect because it is a naturally occurring compound in mammals. Additionally, GHB can be easily converted to and from γ-butyrolactone (GBL). For this work, the detection of GHB and GBL in water and other beverages (vodka and rum) was studied. A timeline of GHB to GBL conversion and GBL to GHB conversion was also established. The analysis of spiked beverages was performed using headspace solid-phase micro-extraction (SPME) gas chromatography-mass spectrometry (GC-MS) with derivatization using N,O-bis(trimethylsilyl)trifluoroacetamide (BSTFA). The same method was employed to study the interconversion of GHB and GBL. It was found that GHB can be detected in water as well as various beverages at small concentrations and that the conversion of GBL to GHB is a zero-order reaction. It was also found that GHB can be converted to GBL when in water and acidic solutions and stored in ambient conditions.

Mentor: John V. Goodpaster, Department of Chemistry and Chemical Biology, School of Science, Indiana University-Purdue University Indianapolis, Indianapolis, IN

35. Mapping Blue Ice Moraine Surface Morphology to Understand Antarctic Climate and Ice Sheet History

Tori Kennedy1, Christine Kassab1, and Kathy Licht1

Department of Earth Sciences, IUPUI School of Science

Blue ice areas of Antarctica are characterized by a net loss of snow/ice, yet hold significant paleoclimate records. Blue ice moraines (BIMs) often form adjacent to these unique areas but little is understood about their formation and evolution. Distinct transitions in surface morphology are observed across these moraines and include hummocky, flat, and ridge and trough topography. We hypothesize that patterns in surface morphology of BIMs have typical spatial and temporal pattern that are related to evolution of the moraines over past glacial and interglacial cycles. By utilizing imagery from DigitalGlobe, we located over one hundred BIMs across the continent of Antarctica and obtained high resolution satellite imagery (Quickbird, Worldview I, Worldview II) for 93 moraines for further investigation of geomorphological patterns. We mapped patterns of change in surface morphology of several BIMs using ArcGIS, and compared the patterns to cosmogenic-nuclide exposure ages across the moraines. Based on our observations, it appears that surface morphology of BIMs can be used to describe the history of the Antarctic Ice Sheet and climates of the past.

Mentors: Kathy Licht, Department of Earth Sciences, IUPUI School of Science


Kiyomi Kukoyi1, David Wilkins1, Daniel Collins1 and Frédérique Deiss1

Department of Chemistry & Chemical Biology, Purdue School of Science, IUPUI

In recent years, more improvised explosive devices are made with chlorate salts are reported. Indeed chlorate salts are easier to use and buy, as they are submitted to less regulations than other common oxidizing agents such as ammonium nitrate. Chlorate ions can also be dangerous contaminants in water. For both forensic and environmental applications, in-field sensing capabilities are needed. Microfluidic paper-based analytical devices are low-cost, portable, flexible, and simple to produce and to use. We are developing an electrochemical paper-based device to detect and quantify the presence of chlorate using a molybdate sensing layer. The redox reactions of the molybdate are catalyzed by chlorate and, thus, we can observe increases in current and shifts in the peaksof potential by electro-analytical techniques such as cyclic voltammetry. Our current work is focused on exploring the best conditions (pH, type of acid, etc.) for the electrodeposition of the molybdate layer and the detection of chlorate, such as the pH and type of acids used. We are also optimizing how we prime the electrodes stencil-painted on the paper, and the washing/drying steps to the most effective and efficient way to clean the paper-based devices so that they can be reused in between measurements. Completing After optimization of these devices we will allow us to resume electrodeposition testing the devices in molybdate on the device solutions and examine test how this system prototyposes reacstin the presence of chlorate. This project aims to permit a convenient collection of samples (explosives mixture or debris) at crime scenes.

Mentor: Frederique Deiss, Department of Chemistry & Chemical Biology, Purdue School of Science, IUPUI
Towards Developing Lipid Profiles from Biological Samples During DNA Typing

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The extraction and analysis of DNA from biological samples is well-established. During a typical DNA analysis, lipids are extracted but not analyzed. Rather than dispose of them, analyzed lipids could convey age, gender, metabolism, diet, and health status of an unknown person. The lipids tested were: palmitic acid, linoleic acid, oleic acid, squalene, and cholesterol. These lipids are commonly found on the surface of skin and hair. Five calibrants were made, each containing the five lipids, ranging in concentration from 0.1 mg/ml -0.02 mg/ml. BSTFA, a derivatizing agent, was added to the five calibrants to stabilize the lipids by transforming them into trimethyl esters. This resulted in relatively stable chromatogram peaks when the calibrants were analyzed using Gas Chromatography (GC) and Mass Spectrometry (MS). The five calibrants were run using temperature ramps 5, 10, 15, and 20. The greater the ramp, the faster the lipids pass through the GC column. When the temperature ramps were 10, 15, and 20, BSTFA did not fully derivatize each lipid, and underivatized peaks were present in the final chromatograms. The lipids that eluted from temperature ramp 5 were fully derivatized, and accurate calibration curves could be created. One can find the concentration of lipids in an unknown solution by comparing the GC/MS results of the unknown solution to the GC/MS results of a known solution. In this way, the concentration of the lipids in an unknown solution can be accurately identified and used to create a more in-depth profile for future suspects.

Mentors: John V. Goodpaster, Department of Forensic Chemistry, School of Science, IUPUI

Micropacked Capillary Gas-Solid Chromatography with 3 and 7.5 μm Particles for Ignitable Liquid Separations using Headspace Sampling

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Traditional packed column gas chromatography (GC) uses columns with large inner diameters (ID) (e.g., 2 or 4 mm) and large particle sizes (e.g., 125–250 μm), resulting in low column efficiency and low optimum carrier gas velocities. In contrast, packing capillary columns with small particles (e.g., 1–20 μm) provides great opportunity to realize extremely efficient separations with very short analysis times, both through increased optimum velocity and decreased column length. Micropacked capillary columns (μPC) can also overcome the limitations of wall-coated open tubular (WCOT) columns where efficiency is increased by reducing the ID, which decreases the sample capacity and phase ratio. Additionally, μPC-GC can utilize the same techniques as Fast WCOT-GC (e.g., extreme oven programming), but with columns of inherently superior separatory and sample capacity characteristics. Here, separations of ignitable liquids, n-alkanes and ASTM E1618 fire debris standard are demonstrated with 3 μm particles in 250 ID μm capillaries. 7.5 μm particles in 530 μm ID capillaries are also evaluated. This was conducted on headspace GC instrumentation with atmospheric outlet and flame ionization detection. Results indicate adherence to theory and support the potential of μPC-GC. Ongoing and future work includes the evaluation of 7.5 and 20 μm particles, utilization of vacuum outlets, operation at nonstandard inlet pressures (i.e., >100 psi), and introduction of liquid stationary phases (gas-liquid chromatography).

Mentor: Associate Professor John Goodpaster, Ph.D.

Determination of the Partition Coefficient of TNT in Chloroform/Water

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Analyzing the overall construction of an explosive device as well as the explosive used can yield information about the bombmaker, terrorist organization, and provide links to other devices. Simultaneous analysis of post-blast debris for DNA and explosive compounds could improve explosive investigations. In this case, DNA and explosive residues would be separated via liquid-liquid extraction. Hence, the partitioning of 2,4,6-trinitrotoluene (TNT), a common military explosive, was studied in water/chloroform. With a log P of 1.6, TNTs expected to partition by approximately 3:2 between chloroform and water. Applying liquid injection to the chloroform solution, good linearity (0.99) was achieved for TNT concentrations between 10 ppm and 50 ppm. It was found that TNT could be detected at two orders of magnitude smaller concentrations for both liquid injection and immersion solid phase microextraction (SPME), but with greater chromatographic resolution and thus linearity for immersion SPME of the aqueous solution. Due to the ability of the M-Vac to collect DNA from rough and porous surfaces, the device will be tested for its effectiveness in simultaneously collecting TNT. Evidence collected via the M-Vac device will be analyzed by these gas chromatography–mass spectrometry application methods after liquid-liquid extraction.

Mentors: John Goodpaster, Department of Chemistry & Chemical Biology, IUPUI School of Science; Christine Picard, Biology Department, IUPUI School of Science
40. PUFA-Induced Domain-ation of Lipid Rafts

Renee Cook, Department of Mathematics, IUPUI

Omega-3 polyunsaturated fatty acids (n-3 PUFA) found in fish oils relieve the symptoms of many chronic diseases by a molecular mechanism that is not properly understood. The cellular membrane is one potential site of action. Here we test the hypothesis that n-3 PUFA promote the clustering of nano-sized lipid domains known as rafts, a process that is believed to activate signaling proteins. Using electron spin resonance (ESR) spectroscopy, we aim to directly observe domains increase in size when PUFA are introduced into a model membrane. This behavior was indirectly inferred from NMR spectra in earlier. Exploiting the faster timescale of ESR, we aim to capture the signal from spin labeled analogs of lipids in different domains. ESR spectra will be presented and discussed.

Mentor: Stephen R. Wassall, Department of Physics, IUPUI

41. The effects of raloxifene analog on bone quality

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Raloxifene is an FDA-approved pharmaceutical drug used to treat osteoporosis in post-menopausal women. In vitro and in vivo studies have shown that in addition to cellular interactions with estrogen receptors, raloxifene improves bone mechanical integrity through its interaction with collagen by increasing matrix hydration, which in turn enhances bone toughness. However, raloxifene is a selective estrogen receptor modulator and young children who suffer from other bone disorders cannot use the drug given its hormonal activity. To combat this issue, work has been undertaken to create a raloxifene analog which lacks an ability to bind to estrogen receptors, but still maintains positive effects associated with collagen binding. Previous in vitro studies have shown similar effect between raloxifene and raloxifene analog. Therefore, the objective of the project is to study and understand the effects of raloxifene analog on bone quality in vivo. Female mice, starting at 8 weeks in age, were injected subcutaneously with either raloxifene, raloxifene analog, or no treatment five days per week for 8 weeks. The mice were also injected with calcin and alizarin at weeks 15 and 16, respectively, to quantify bone formation dynamics. After 16 weeks, the mice were euthanized and tibiae were harvested, scanned by microcomputed tomography, and mechanically tested to failure. The outcome of these experiments includes bone morphology and mechanical integrity.

Mentor: Joseph Wallace

42. The Effects of Epigallocatechin-gallate on Dental Adhesives and MMP Inhibition

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Matrix metalloproteinase (MMPs) have been shown to play a substantial role in dentine's collagen matrix breakdown, which may contribute to the potential failure of dental restorations over time. Therefore, modifications in the current dental adhesive system are necessary that would inhibit the uncontrolled activities of the MMPs. Epigallocatechin-3-gallate (EGCG) was selected as a MMP inhibitor to be incorporated within the dental adhesives. The objective of this study was to investigate the potential changes in the chemical and mechanical properties of modified-dental adhesives by adding different concentrations of EGCG and evaluate their ability to inhibit MMP activity. Disk-shaped specimens of dental adhesive were prepared containing 0%, 0.1%, 0.05%, 0.025%, and 0.0125% of EGCG. The degree of conversion (DC) and Knoop-microhardness were performed to relativity compare the degree of polymerization and mechanical properties, respectively. Gelatin zymography was used to assess inhibitory effects of EGCG on MMP-9 proteolytic activity. The result showed no significant statistical differences among the groups in the Degree of conversion (DC) test (p=0.185), as well as Knoop-microhardness (p=0.252). A positive correlation was found between DC and Knoop-microhardness using Pearson correlation coefficient (p=0.001). EGCG groups demonstrate a dose-dependent inhibition of MMP-9 activity by zymography. Accordingly, the incorporation of EGCG up to 0.1% did not affect the dental adhesives used in this study, and all EGCG concentrations showed a dose-dependent of MMP inhibition. This study suggests that EGCG additives may expand the life-span of dental restorations in the clinic by enhancing the biostability and integrity of resin-dentin interface.

Mentor: L. Jack Windsor, Department of Oral Biology, IUSchool of Dentistry
43. A qualitative analysis to understanding participation in physical activity and sedentary behaviors in veterans with fibromyalgia

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Fibromyalgia (FM) is characterized by chronic widespread musculoskeletal pain. Associated symptoms of fibromyalgia include fatigue, sleep disturbances, memory, mood difficulties, and exacerbation of symptoms with physical exertion. When compared with age-matched controls, individuals with fibromyalgia are generally considered extremely sedentary and spend less time participating in physical activity of all intensities. Physical inactivity is generally associated with all-cause mortality and likely contributes to increased mortality rates in people with fibromyalgia. The aim of this qualitative study was to explore veterans with FM's perceptions of and attitudes towards involvement in physical activity. Three veterans with FM were recruited to participate in either individual or group semi-structured interviews using standardized questions and prompts. The qualitative interviews were recorded, transcribed, and analyzed using thematic analysis. This approach identified emerging, recurrent themes or patterns in the interviews. Themes included but were not limited to “barriers to being physically active”, “barriers to reducing stationary activity”, and “motivations for being less sedentary”. Next steps in this research will include identifying emerging subthemes. Knowledge of barriers and motivation for physical activity will inform our planned intervention to improve physical activity behaviors and reduce stationary time in veterans with fibromyalgia.

Mentor: Kelly M. Naugle

44. Identification of Genes Important for the Pathogenesis of Lyme disease

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Lyme disease is the number one vector-borne infection in the United States. It is caused by Borrelia burgdorferi spirochaetes that are transmitted by Ixodes spp ticks. Upon infection, Lyme disease results in disorders such as arthritis, neuroborreliosis, and carditis. Lyme disease is treatable with antibiotics; however, late stages are difficult to treat and there is no commercial vaccine currently available for prevention. B. burgdorferi exhibit a spiral shape that plays a significant role in the pathogenesis of the spirochete. More importantly, cell shape mutant is likely involved in pathogenesis. Strains of mutants from random transposon mutant libraries were grown in BSKII media and incubated for growth. Morphology change as well as the major virulence factor Outer-Surface-Protein C (OspC) expression were screened. Nineteen clones –10 abnormal morphologies and 9 depleted OspC expressions – were identified. Cloning and sequencing were performed and genes that were responsible for depleted OspC expression and morphology change were identified. Future experiment is to screen more plates to identify candidate genes responsible for cell shape as well as for OspC expression in B. burgdorferi. In addition, sets of these genes will be subjected to infection study to determine their infectivity in the murine Lyme disease model. Furthermore, the mechanism of action of these factors will be hypothesized and tested accordingly. A strategy to target these gene products for preventing and treating Lyme disease will be proposed.

Mentor: Frank Yang, Department of Microbiology and Immunology, IU School of Medicine, IUPUI.

45. Expression of Progesterone Receptors in Ovarian Cancer Cell Line

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High-grade serous carcinoma (HGSC) is the deadliest subtype of ovarian cancer that arises from ovaries and fallopian tubes. Understanding the mechanisms of the proteins and hormones that regulate progression or repression of the cancer is vital to future medical interventions. To do so, mouse models have been developed to study ovarian cancer, specifically HGSC. One of which is the Dicer1-Ptendouble-knockout (DKO) mouse is a model for HGSC that we have developed. This model shows HGSC formation and progression phenotypically similar to human HGSC. A key finding from this model was that the removal of both ovaries led to a slowed progression of HGSC. Subsequent injections of estrogen to the ovaries-free DKO mice completely enabled the formation of HGSC tumors in these mice. However, progesterone injections turned the ovaries-free DKO mice bearing HGSC tumors to die earlier. The role of progesterone appears to be significant in HGSC formation. Interestingly, progesterone receptors are only present in the early stages of HGSC, but not in advanced stages. The goal of this project is to utilize DKO cell lines obtained from DKO primary tumors by introducing the lost progesterone receptors to these cell lines and treating them with progesterone to map the effects of progesterone and assess its potential tumorigenic activity.

Mentors: Jaeyeon Kim, Ph.D., Department of Biochemistry and Molecular Biology, IU School of Medicine
46. Investigating the role of plasma uric acid levels in Ugandan children with severe malaria

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Malaria is a highly inflammatory disease caused by the protozoan parasite Plasmodium and is one of the leading causes of mortality and morbidity in children in sub-Saharan Africa under the age of 5. P.falciparum malaria pathogenesis is a complex process that begins with the activation of innate immune cells by Plasmodium-derived components (pathogen-associated molecular patterns, PAMPs) and host-derived components (damage-associated molecular patterns, DAMPs). Uric acid has been identified as an important malaria DAMP, associated with the development of a pro-inflammatory environment, which has been implicated in the pathology of P. falciparum malaria. We are investigating the association of UA with mortality and disease severity in Ugandan children with severe malaria. Plasma samples were collected from a cohort of Ugandan children, 18 months –12 years of age, with cerebral malaria (CM), severe malaria anemia (SMA), and age-matched, healthy community children (CC). Testing has been completed on a subset (174 samples) of a total of ~750 samples. UA levels were measured using a colorimetric assay. Preliminary data obtained from the subset tested shows a significant difference between plasma UA levels in children with severe malaria (median = 15.5059 mg/dl, [IQR = 20.3188], and CC's (median = 11.4169 mg/dl, [IQR = 4.2249], p = 0.01), suggesting an association between elevated plasma UA levels and disease severity. Further tests to confirm these findings in the full cohort and to examine associations with mortality and disease severity are underway and will potentially help solidify the role of UA as an important contributor to the pathogenesis of severe malaria.

Mentor: Chandy C. John, Department of Pediatrics, Indiana University School of Medicine, Indianapolis, IN

47. “How did they not mention that?” - A Systematic Review of Adolescent and Young Adult Cancer Survivors’ Experiences of Fertility, Sexuality, and Romantic Relationships

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1 IU School of Nursing

Introduction: Adolescent and young adult (AYA) cancer survivors struggle with many psychosocial challenges that threaten their ability to achieve important developmental milestones. Some of the most distressing challenges involve infertility, psychosexual distress, and strained romantic relationships. There is a knowledge deficit regarding AYA’s experiences of these issues and their survivorship needs. Objective: The purpose of this systematic literature review is to analyze and synthesize qualitative data regarding AYA experiences of fertility, sexuality, and romantic relationships and provide recommendations for practice and research. Methodology/Approach: Three databases (PubMed, PsychINFO, Ovid) were used to identify qualitative studies published between January 2007 and September 2017. Inclusion criteria: cancer survivors diagnosed during adolescence or young adulthood, aged 13-39. Exclusion criteria: childhood cancer survivors. Results: 13 studies met inclusion criteria. Our next step was to assess methodological quality of each study using guidelines for analyzing qualitative research. We identified the categories that illustrated commonalities of AYA experiences using an abbreviated phenomenological method. Themes identified include (1) compromised fertility; (2) disrupted identity; (3) relationship strain; (4) psychosexual distress; (5) poor provider communication. Conclusion: Understanding AYA cancer survivors’ experiences of fertility, sexuality, and romantic relationships is important to help minimize psychosocial distress and develop strategies to meet their needs. These topics are sensitive and minimally addressed in the current clinical setting. Recommendations include (1) increasing the involvement of fertility specialists; (2) enhancing provider awareness of these issues and confidence in communication regarding fertility; (3) finding age-appropriate ways to help AYA patients cope with issues regarding fertility, sexuality, and romantic relationships.

Mentor: Celeste Phillips PhD RN
48. Identifying influential Trisomic Genes in Addition to Dyrk1a that Contribute to Skeletal Phenotypes found in Down Syndrome
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The mechanisms involved in the genetic expression found in trisomy 21 (T21) that result in the presentation of abnormal phenotypes have been shown to be extremely complex. Early-onset osteoporosis is an example of a skeletal developmental defect resulting from T21. The Ts65Dn mouse model is commonly used in the research of Down syndrome (DS) and has been shown to exhibit similar skeletal phenotypes present. Additional DS mouse models have been created that have a higher number of trisomic genes in three copies and different trisomic segments that are orthologous to human chromosome 21 (HSA21). The additional strains follow as contiguous segmental duplications of the principal strain that result in partial trisomies of mouse chromosome 16 (Mmu16), which is orthologous to a large segment of HSA21, allowing for comparative analysis of skeletal abnormalities. We have examined the skeletal phenotypes of the Dp2Tyb strain, which contains a partial trisomy of genes between MIS18A and RUNX1. The trisomic gene Dyrk1a, a gene not present in the Dp2Tyb strain, has been shown to be important in many DS skeletal abnormalities. Genes of interest that are trisomic in the Dp2Tyb strain include Regulator of calcineurin 1 (RCAN1) and Runt related transcription factor 1 (RUNX1), two genes that may play important roles in skeletal formation and maintenance. Structural and mechanical analysis alongside histological examination of skeletal phenotypes of the Dp2Tyb model, with a comparison of the other strains generated from the mapping panel, will provide insight into the complex genetic and phenotypic interactions found in DS.

Mentor: Randall J. Roper

49. Investigation of the efficacy of p65(NF-κB, RelA) gene knockdown via siRNA and treatment with DCA to increase pancreatic cancer radiation sensitivity
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Even with the tri-modality therapy options of surgery, chemotherapy, and radiation therapy, pancreatic cancer (PDAC) remains the third leading cause of cancer death in the United States with a 5-year survival rate of 9%. The low survival rates of PDAC are attributed to detection at advanced stage and very high chemo and radiation resistance, therefore PDAC needs novel approaches to improve therapeutic outcome. Our approach to improve the radiation sensitivity of PDAC is to target two cellular processes, NF-κB signaling pathway and Warburg cancer metabolism, that are critical for PDAC survival. NF-κB promotes cell survival, tumor progression, angiogenesis, and reduces susceptibility to apoptosis. Warburg cancer metabolism is an alternative metabolic pathway that promotes rapid cell growth. We investigated the efficacy of simultaneous inhibition of the pro-survival NF-κB signaling pathway and Warburg cancer metabolism (oxidative glycolysis) with the drugs Dimethyl-amino-parthenolide (DMAPT) and Dichloroacetate (DCA) on radiation sensitivity. We have reported that the combination of DMAPT and DCA sensitizes pancreatic cancer to radiation-induced cell killing. To further investigate whether direct inhibition of the NF-κB family member p65 (RelA) gene in combination with DCA treatment and tested whether this combination increases the radiation sensitivity of pancreatic cancer cells.
Cell spheroids are increasingly used as in vitro 3D tissue (including tumor) models and as building blocks for tissue engineering. The 3D Bioprinting Core at IUSM/IUPUI is equipped with the bioprinter ‘Regenova’, a robot that skewers pre-formed cell spheroids into larger 3D constructs, in a scaffold-free manner. Since these structures are not vascularized, the cells are vulnerable to metabolic conditions (such as glucose and oxygen availability), which could be optimized both empirically and by computational modeling. In this continuation MURI project, spheroids of human ovarian cancer cells HeyA8 were prepared from 20,000 cells placed in non-adhesive U-shaped wells in RPMI 1640 medium with 10% bovine serum. After 3 days, the spheroids were solubilized, along with 2D cultures, for NMR analysis. For detecting oxygen, we continued the setting up and calibration of the EPR instrument. We detected the glucose peaks in the NMR charts of 2D cultures and spheroids, and made progress toward oxygen quantification. To simulate the spheroids and their dependence on glucose, we used the open-platform software CompuCell3D (CC3D). By monitoring the distance between the geometric ‘center of mass’ of fusing spheroids, we showed how the amount of available glucose impacts the fusion rate, via the combined effect of cell compaction, survival and proliferation. In conclusion, HeyA8 tumor cell spheroids are usable as building blocks for scaffold-free bioprinting. Our in vitro and in silico analysis confirms the sensitivity of their shapes and fusion kinetics on metabolic factors, which deserves further exploration with use of NMR metabolomics and EPR oximetry.

Mentors: Nicanor I. Moldovan, Department of Biomedical Engineering, School of Engineering and Technology, Department of Ophthalmology, Bioprinting Core at IUPUI/IUSM; Bruce Ray and Horia Petrache, Department of Physics, School of Science, Indiana University-Purdue University Indianapolis

CaMKK2 as a Dual Strategy to Alleviate Metastatic Tumor Burden and Treatment-Induced Bone Loss in Advanced Prostate Cancer Patients

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Androgen Deprivation Therapy (ADT) is the standard of care to treat advanced-stage prostate cancer (PCa). Although it significantly improves survival rates, ADT detrimentally affects bone health and results in bones characterized by low bone mass and increased susceptibility to fragility fractures (treatment-induced bone loss). Within 1-2 years of ADT, the tumor relapses into a hormone-resistant disease by upregulating the androgen receptor in response to low testosterone levels. Therefore, it would be beneficial to find a target that can preserve bone quality as well as decrease PCa metastatic tumor burden. Ca2+/calmodulin (CaM)-dependent protein kinase kinase 2 (CaMKK2) plays important roles in both the anabolic and catabolic pathways of bone modeling through stimulating osteoblasts (OBs) and inhibiting osteoclasts (OCs). CaMKK2 is abnormally over-expressed in metastatic PCa and its ablation significantly impairs the growth of advanced stage prostate cancer in vitro and in vivo. Moreover, our preliminary studies indicate that CaMKK2 inhibition decreases 3-D spheroid size in human PCa cell line, C4-2B and mouse cell line RM-1. We hypothesize that CaMKK2 inhibition will promote bone remodeling in mice and reduce PCa tumor burden. To investigate this, we performed sham surgery or bilateral orchiectomy (ORX) to simulate ADT in 8 week old male athymic mice and treated them for 12 weeks with either saline or STO-609, a CaMKK2 inhibitor. ORX resulted in a 4-fold decrease of trabecular bone volume compared to the STO-609 treated mice who possessed 2-fold higher bone volume and trabecular number as well as a 2-fold reduction in trabecular separation.

Mentors: Dr. Uma Sankar, Department of Anatomy and Cell Biology, Indiana University School of Medicine; Dr. Ushashi Dadwal, Department of Anatomy and Cell Biology, Indiana University School of Medicine
52. Researching a Pharmaceutical Treatment For Hydrocephalus  
**Symphony Davis1, Alexander Hochstetler2, Daniel Preston2, Stefanie Simpson2, Caleb Danko2, Bonnie Blazer-Yost2**  
1Neuroscience Department, School of Science; 2 Biology Department, School of Science

Hydrocephalus, more commonly known as “water on the brain”, is a debilitating condition caused by the accumulation of cerebral spinal fluid (CSF) in the ventricles of the brain. This accumulation of CSF, due to the lack of regulation by the ventricles and the blood, causes an enlargement of both the brain ventricles and head size in infants. This devastating disease affects approximately 1 out of every 1000 infants born. The infants display characteristics such as delayed development, loss of coordination, cognitive difficulties, pain, and sadly even death. Hydrocephalus can also occur as a secondary consequence of traumatic brain injury. In the geriatric community there is an underdiagnosed form of the disease called normal pressure hydrocephalus. In hydrocephalus, the buildup of CSF that is meant to protect and nourish, can cause a brain-damaging disease. Preliminary data show that by antagonistically blocking an ion channel called the transient receptor potential vanilloid type 4 (TRPV4) in the choroid plexus (where CSF production occurs), the development of hydrocephalus in a rat model of the disease will substantially decrease. With the aforementioned information, my specific project within Blazer-Yost lab entails performing the techniques of cryosectioning to make very thin slices of specific brain areas and immunofluorescence to localize proteins within those sections. Both techniques are needed to determine the relative presence/amount of the TRPV4 protein within the ventricular system of the brain. These two techniques, among others, will be crucial for the hydrocephalus project in order to achieve our desired result of a pharmaceutical cure.

Mentors: Bonnie Blazer-Yost and Alexander Hochstetler, Department of Biology, School of Science, IUPUI.

53. Systematic Survey of the Role of IGF in the Link between Diabetes and Cancer  
**Nirupama Devanathan1 and Ann C. Kimberly-Hill1**  
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Epidemiological studies have proposed a link between Type II diabetes and cancer via the IGF/insulin signaling pathway, which includes insulin-like peptides (IGF1, IGF2, and insulin), insulin receptors (IR-A, IR-B, IGF1R, and hybrids), and insulin substrate proteins (IRS1-6). In this study, up- and down-regulation of individual components in IGF/insulin signaling were compared to clinical outcomes for cancer patients: diagnosis age, overall survival, tumor invasion and vascularization, and body mass index. It was found that the up-regulation of IGF/insulin components was associated with overall survival and tumor invasion and vascularization, while the down-regulation of the same was not associated with any clinical outcomes assessed in this study. Particularly, the up-regulation of DOK5, IGF2, and IRS2 in colorectal cancer and IGF1R in liver cancer was associated with significantly decreased overall survival. Functional aberrations in either of the two proteins in co-expression pairs were identified for each cancer and correlated with overall survival and diagnosis age. Specific biomarkers, proposed in this study, will be further analyzed to fine-tune consistent associations that can be translated to reliable prognostic standards for the roles of IGF/insulin signaling pathway modifications that promote cancer. Keywords: Type II diabetes (T2DM), colorectal cancer, liver cancer, pancreatic cancer, uterine cancer, insulin growth factor (IGF), insulin receptor (IR)

Mentor: Ann C. Kimberly-Hill, Department of Biochemistry and Molecular Biology, IU School of Medicine

54. Measuring the Effect of Active Video Games on Aerobic Outcomes and Enjoyment in Young Healthy Adults  
**Eric Evans1, Kelly Naugle2; Keith Naugle2;**  
1Department of Health Sciences, School of Health and Rehabilitation Sciences; 2Department of Kinesiology, School of Physical Education and Tourism Management

Active gaming requires movement during play, and thus provides alternate methods to achieve physical activity. This study examined the effects of active games on heart rate (HR), ratings of perceived exertion (RPE), and enjoyment. Eleven (n=11) healthy individuals completed four separate gaming sessions. Participants underwent an initial familiarization session followed by three separate sessions during which the following games were played: Kinect Tennis, Kinect Fighter Within, and Wii Boxing. Participants played two fifteen-minute periods per session: one at self-selected level of activity and one using structured instructions designed to enhance movement. Heart rate (HR) and RPE (Borg RPE scale: 6-20) were recorded every five minutes and enjoyment was measured at the end of each period using a 10cm visual analogue scale. Repeated measures analysis showed a main effect of game and period (p<0.001, p<0.001, respectively) for HR. Fighter Within (119.2±4.6) and Wii Boxing (116.8±4.5) showed higher average HR than Kinect Tennis (104.2±4.5). Average HR in Period 2 (124.5±5.5) was significantly higher than Period 1 (102.3±4.2). RPE was significantly higher during Fighter Within (10.9±0.41) and Wii Boxing (10.3±0.6) compared to Kinect Tennis (9.0±0.4; p<0.001). RPE values were significantly higher in Period 2 than Period 1 (11.3±0.6 vs. 8.9±0.4, respectively). Enjoyment (p<0.004) in Period 2 was significantly higher than Period 1 (6.0±0.4 vs 5.0±0.4, respectively). Results suggest that structured levels of activity contribute to higher overall HR, RPE’s, and enjoyment while playing active video games, suggesting that active gaming can produce health benefits as a form of physical activity.

Mentor: Kelly Naugle, Department of Kinesiology, IU School of Physical Education and Tourism Management, IUPUI; Keith Naugle, Department of Kinesiology, IU School of Physical Education and Tourism Management, IUPUI
55. Climate Change Vulnerability Index for Marion County, IN

Mentor: Dr. Yi Wang, Assistant Professor, Environmental Health Science, Richard M. Fairbanks School of Public Health, IUPUI

The growing threat of climate change has led to an increase in heavy precipitation (i.e. ‘cloudburst’) events within the Midwest. Highly urbanized areas are susceptible to localized flooding during these cloudburst/precipitation events. Recent hazard assessments of these cities have often focused on the economic risk accompanying flooding events with limited focus on the risk of pollution migration from hazardous sites, like brownfields, to surrounding areas. Using Geographic Information Systems (GIS) to identify areas at risk for localized flooding during cloudbursts, along with the addition of brownfield risk assessments, a screening method was developed to identify Indianapolis brownfields that may pose an increased risk due to the increased frequency of natural hazards associated with climate change. Thirty years of precipitation data collected from Central Indiana was analyzed in order to predict the frequency of these localized flooding events and predictions of increased cloudburst events under future climate change scenarios were also considered. This analysis resulted in a spatially explicit flooding hazard assessment that will be incorporated as part of a comprehensive climate vulnerability index. The next steps in creating the vulnerability index will include gathering and assessing data related to extreme heat, cold, wind, and increased frequency of natural disasters (i.e. tornadoes) within Marion County, IN.

56. GABRA2 Expression in Selectively Bred Mouse Lines for High and Low Alcohol Drinking

Mentor: Dr. Yi Wang, Assistant Professor, Environmental Health Science, Richard M. Fairbanks School of Public Health, IUPUI

Human association studies show that the GABA A α2-subunit (GABRA2) gene is one of the most linked subunits to alcoholism. Human studies suggest that this link may be due to risk alleles that alter expression of GABRA2, with this alteration serving as a potential risk factor for alcoholism. Due to the limitations of exploring this further in humans, we sought to study the impact of GABRA2 on alcoholism using mouse lines genetically selected for High-(HAP) and Low-(LAP), two-bottle choice alcohol preference drinking. In the current study, replicate 2 lines (HAP2/LAP2) of mice were used. The current study explored potential line differences in whole brain expression of Gabra2 (mouse homolog of GABRA2) protein in HAP2 and LAP2 mice (experiment 1), as well as the extent to which a 3-week alcohol drinking history alters Gabra2 expression in HAP2 mice (experiment 2). Based on previously observed line differences in Gabra2 mRNA expression, we predicted that HAP2 mice would exhibit elevated whole brain Gabra2 protein expression. However, Gabra2 expression did not differ between HAP2 and LAP2 mice in experiment 1. In experiment 2, we predicted that exposure to 24 hr two-bottle choice alcohol (10% v/v) would result in elevated Gabra2 expression compared to water-drinking controls. Results showed that whole brain Gabra2 expression was marginally elevated in HAP2 mice following EtOH drinking. These results support the purported links between the presence of the GABRA2 risk allele, altered GABRA2 expression, and alcohol use disorder observed in humans.

Mentor: Stephen L. Boehm II, Department of Psychology, Indiana University –Purdue University Indianapolis

57. Rapid Degradation of EGCG Impairs Targeted Inhibition of Dyrk1a

Mentor: Randall J. Roper

Down syndrome (DS), resulting from full or partial trisomy of chromosome 21 (T21), is the leading genetic cause of intellectual disability (ID); additionally, increased gene dosage from T21 causes deficiencies in skeletal development, resulting in shorter stature and increased fracture risk. Dual-specificity tyrosine-regulated kinase 1a (DYRK1A) is a putative gene target located on chromosome 21 hypothesized to play a role in neurogenesis and skeletal development. In vitro studies reported that the green tea polyphenol epigallocatechin-3-gallate (EGCG) is a potent inhibitor of DYRK1A. Genetic normalization of Dyrk1ain Ts65Dn mice yielded promising results, including improvement of trabecular microarchitecture and overall bone strength. In vivo studies administering ~9 mg/kg/day pure EGCG in drinking water improved bone phenotypes, but 200 mg/kg/day pure EGCG via gastric gavage to Ts65Dn DS mice impaired bone microarchitecture and strength. EGCG is a promiscuous and unstable polyphenol that interacts with a multitude of proteins which cause it to change conformation or degrade. To determine the bioavailability of EGCG in euploid and Ts65Dn mice, 200 mg/kg/day pure EGCG was administered via gastric gavage for two consecutive days. Serum was collected at 30, 60, and 90 minutes after administration on the second day and analyzed by liquid chromatography-tandem mass spectrometry (LC-MS/MS). Serum EGCG concentration decreased over time in euploid mice; Ts65Dn mice showed higher serum EGCG concentrations. These data suggest that EGCG is quickly metabolized, reducing its effectiveness as a Dyrk1a inhibitor. Future studies will rely on more potent, bioavailable Dyrk1a inhibitors to curb Dyrk1a-related phenotypes.

Mentor: Randall J. Roper
58. Induction of Ascl1 in Maternal Liver Ensures a Healthy Pregnancy
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Maternal liver exhibits robust adaptations to pregnancy to accommodate metabolic needs of developing and growing placenta and fetus by largely unknown mechanisms. Achaete-scute homolog-like 1 (Ascl1) is a basic helix-loop-helix transcription factor essential for neuronal development. We found that this gene is highly induced in the maternal liver during the second half of gestation in both humans and mice. Our aim is to determine whether and how Ascl1 plays a pregnancy-dependent role. Using in vivo tracing mouse models, we found that Ascl1-expressing cells represent a major subpopulation of maternal hepatocytes. Thus, using an AAV8-TBG-Cre virus-mediated approach, we deleted the Ascl1 gene specifically in maternal hepatocytes in pregnant Ascl1floxt/floxt mice and analyzed their phenotypes. As a result, we identified multiple Ascl1-dependent gestation defects. When maternal hepatocytes lost Ascl1, they displayed aberrant structure, increased proliferation, fat accumulation, and reduced albumin production, indicative of maternal liver dysfunction. Moreover, Ascl1 absence in maternal hepatocytes led to strikingly enlarged maternal spleen and the placenta with expanded glycogen cell population. Furthermore, pups born to dams lacking hepatic Ascl1 exhibited accelerated growth in the first two weeks after weaning. By RNA-seq analysis, we have linked a subset of Ascl1 target genes with these Ascl1-dependent phenotypes. These findings demonstrate that Ascl1 induction in the maternal liver is essential for ensuring the health of both the mother and fetus and that maternal liver plays several unexpected roles including the regulation of placental and fetal development and maternal spleen adjustment.

Mentor: Guoli Dai, Department of Biology, School of Science, IUPUI

59. Assessment of TLR-2 Expression in Salivary Epithelial Cells for Early Identification of Periodontitis
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Periodontitis is an inflammatory disease of the gingiva and the tissues surrounding the tooth. The disease is prevalent affecting greater than 20% of adults in the United States. Severe periodontitis leads to the destruction of the tooth supporting tissues and tooth loss. It is more common in people with other chronic diseases such as diabetes and cardiovascular disease. The current methods of identification of progression of the disease are physical in nature that measure the tissue damage but provide no background on the actual disease activity. The disease is mediated by the interaction between the dental plaque biofilm, the oral epithelial cells and the host immune cells. Due to the physiological turnover, the oral epithelial cells are exfoliated into the saliva. Hence epithelial cells in saliva are a viable option for studying periodontitis progression. These cells recognize and respond to bacterial via toll like receptors. TLR-2 and TLR-4 mediate disease response to the pathogens associated with periodontitis. The objective of this study is to investigate the TLR-2 and TLR-4 expression in the salivary epithelial cells in periodontitis. By better understanding progression, the re-infection and disease of the tissue can be better understood and eventually better managed. Archived saliva samples collected in accordance with the ethical board of the Indiana University Purdue University at Indianapolis from periodontitis patients reporting to the IU School of Dentistry was used. The TLR-2 and 4 mRNA in salivary epithelial cells were determined by quantitative real time polymerase chain. Results showed that the TLR-2 mRNA was significantly lower in the periodontitis group, suggesting the presence of activated responsive epithelial cells. In conclusion salivary epithelial cell phenotype measurement may help identify highly relevant biomarkers for disease progression in periodontitis.

Mentor: Mythily Srinivasan, Department of Oral Pathology, Medicine and Radiology, IU School of Dentistry, IUPUI
60. Active-site Mutants of Benzoylformate Decarboxylase Provide a Variety of Implications for the Roles of the Active-site Residues, His70 and His281

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Benzoylformate decarboxylase (BFDC) is a thiamin diphosphate (ThDP)-dependent enzyme, initially isolated from Pseudomonas putida. BFDC catalyzes the decarboxylation of benzoylformic acid to benzaldehyde and carbon dioxide. In a side reaction, BFDC also exhibits carboligase activity enabling the formation of stereospecific α-hydroxyketones that are of industrial interest. The putative mechanism of BFDC essence involves four intermediate steps. It is known from previous site-directed mutagenesis studies that the active site residues, Ser26, His70 and His281 play important roles in the catalytic mechanism. In this project, we explore the specific contributions of the His70 and His281 residues to the individual catalytic steps using recently developed NMR spectroscopy technique. Variants containing mutations at His70 and His281 were over-expressed in E. coliand purified using nickel affinity chromatography. The Michaelis-Menten parameters (kcat and Km) were determined for each variant using a NADH-linked coupled assay. Subsequently, NMR coupled with rapid acid-quench was used to determine relative concentrations of reaction intermediates and thereby, rate constants for the intermediate steps. Here we report those results and discuss their implications for the roles of His70 and His281 in the BFDC mechanism. Moreover, the unanticipated role of His70 in stabilizing ThDP binding with BFDC is also discussed.

Mentors: Michael J. McLeish, Department of Chemistry and Chemical Biology, IU School of Science, IUPUI; Bruce D. Ray, Department of Physics, IU School of Science, IUPUI

61. Effect of Nicotine on Streptococcus mutans Binding to Collagen

Courtney McGrew and Dr. Richard Gregory

Streptococcus mutans is a cariogenic bacterial species because it can bind to connective proteins, such as collagen, in the oral cavity and produce lactic acid which demineralizes enamel surfaces. This characteristic of S. mutans heightened in the presence of nicotine due to an increase in growth on the tooth surfaces and upregulation of virulence genes. Oral bacteria can enter the bloodstream many ways. Once oral bacteria, specifically those with the capability to bind to connective proteins, like S. mutans, enter the bloodstream, they can bind to connective proteins produced by and found on the extracellular membranes of endothelial cells in the blood vessel walls and begin to colonize. These colonies can be the initiation of arterial plaque formation, leading to hardening of the blood vessels, which can further develop into atherosclerosis. This study examined biofilm growth of several strains with known genotypes for collagen binding in various concentrations of nicotine using crystal violet staining as well as collagen biofilm binding in various concentrations of nicotine using an ELISA method. There is a statistically significant increase (p<0.05) in S. mutans biofilm growth and biofilm binding to collagen in the presence of nicotine concentrations in most strains from nicotine concentrations 2 to 16 mg/mL. This supports previous findings that nicotine increases S. mutans biofilm growth. It also supports our theory that there should be an increase in collagen binding if there is an increase in biofilm growth, and thus could lead to an increased risk of atherosclerosis in nicotine consumers.

Mentor: Dr. Richard Gregory from the Indiana University School of Dentistry Department of Biomedical and Applied Sciences

62. Gender Differences in Intracerebral Hemorrhage Risk Factors and Severity

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1IUPUI School of Science; Indiana University School of Medicine Departments of 2Neurology; 3Biostatistics; 4Radiology

Intracerebral hemorrhage (ICH) has the highest morbidity and mortality of all stroke subtypes. Women have been found to suffer more severe strokes with slower recoveries but risk factors specific to women remain largely unknown. This research aimed to illuminate these factors and emphasize the importance of developing sex-specific treatment options to prevent and treat stroke. Patients admitted for spontaneous ICH from 2009-2013 (n=888) were retrospectively identified. A univariate analysis comparing men (n=476) and women (n=412) was conducted to reveal trends that may explain dissimilar stroke pathophysiology between sexes. Women were found to experience their strokes an average of 4.5 years later in life (p<0.0001), but in contrast with other studies, were not found to have any significant difference in 30-day (p=0.68) or 1-year (p=0.37) mortality. We found that men were more likely to have smoked or be a smoker (p=0.0003), as well as develop pneumonia in the hospital (p=0.0012). Men were also admitted with higher systolic blood pressure (p=0.0078) and diastolic blood pressure (p<0.0001) than women. Women were found to experience lobar hemorrhages more often than men (p=0.0002), while men had more intraventricular hemorrhage (p=0.011) and deep hemorrhages (p=0.0006). The reasons for these differences are unknown and future research with a prospective cohort should be conducted to explore this important topic further.

Mentor: Ashley D. Blatsioris, Department of Neurology, IU School of Medicine, IUPUI
63. A Pseudo-likelihood Method For Estimating Misclassification Probabilities When Outcome Data are Partially Observed.

Philani Mpofu, Giorgos Bakoyannis, Constantin Yiannoutsos
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The problem of misclassification of binary outcome data has been extensively studied, with remedies such as internal validation sampling using a gold standard diagnostic procedure having been proposed in order to correctly perform statistical inference. However, due to financial and other constraints, internal validation sampling is not always feasible. It is, thus, very important to estimate misclassification probabilities from studies with internal validation and use these estimates to correct for misclassification in studies without internal validation. For the first task, we propose a computationally efficient pseudo-likelihood method for estimating misclassification probabilities when true outcomes are partially observed. We then show how these estimates can be applied in an external study to correct for misclassification. We show the root-n consistency of the estimator and its asymptotic normality. We also derive a closed-form variance estimator that accounts for all sources of uncertainty. We illustrate the method using data from a HIV cohort study in sub-Saharan Africa to estimate death under-reporting in settings where internal validation has not been performed.

Mentors: Constantin Yiannoutsos, Indiana University Richard M. Fairbanks School of Public Health; Giorgos Bakoyannis, Indiana University Richard M. Fairbanks School of Public Health.

64. Lihawu Male Mentoring Camp: Understanding the Long Term Impacts on Attitudes and Perceptions Relating to Male Circumcision, HIV/STI Knowledge, Gender Inequalities and Masculinities in Swaziland

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With approximately 31% of the adult population (18-49) living with HIV, Swaziland has implemented various strategies to reduce the rapid spread of HIV such as voluntary medical male circumcision (VMMC). Studies show that Swaziland's patriarchal society perpetuates gender inequalities embedded in its cultural, social, political, and economic environments which affect the disparate transmission of HIV in the country. As a way of mitigating these gender inequalities, programs have focused on women's empowerment leaving men behind. We argue that involving men in HIV prevention interventions will complement programs focusing on women. The 3-day Lihawu Male Mentoring Camp (LMMC) for young men ages 15-29 offers a package of biomedical male health services including HTC and VMMC. Eleven focus groups with 43 participants were conducted to understand the long-term impacts of the LMMC on attendees' attitudes and perceptions towards the camp objectives. A purposeful and convenient sampling of LMMC attendees that opted for circumcision was compared to the control group of routinely circumcised individuals who did not attend camp. The thematic analysis of the data revealed that the camp attendees were more informed and receptive towards themes relating to gender equality, positive masculinities, sexual consent, condom usage, STIs, HIV/AIDS, male circumcision and goal setting unlike the routinely circumcised young men who were more resistant and less knowledgeable about the aforementioned topics. These findings will inform the LMMC to better meet the needs of its target audience as well as enlighten the design of future research studies, interventions and policies relating to similar topics.

Mentor: Alfred A. Adams & Dennis P. Watson

65. Quantifying Soft Tissue Manipulation

Josh Roy1 and Terry Loghmani2
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Instrument-assisted soft tissue manipulation (IASTM) has been used since ancient times, yet a clinically-applicable means does not exist to quantify this treatment modality with metrics. This deficit in the field of rehabilitation is what led to the development of Quantifiable Soft Tissue Manipulation (QSTM). In order to assess the need for a mechatronic medical device such as QSTM, research and development team members performed local and national surveys, as well as customer discovery interviews. In the local and national surveys, interviewees were asked whether they felt a need for quantifying soft tissue manipulation. The results from these surveys showed the overwhelming consensus for this need. The customer discovery interviews were completed under the guidance of the NSF iCORPS program. During the interviews, clinician and physical therapy students were asked an array of questions in regard to their experience with soft tissue manipulation and issues with this area of treatment. The results from these interviews further backed the results of the initial surveys as well as provided other data on therapist’s frustrations and desires in manual therapy. Overall, the results of these surveys confirm the hypothesis and need for the quantification of soft tissue treatment.

Mentor: Terry Loghmani School of Health and Rehabilitation Sciences, Department of Physical Therapy, IUPUI
Movement of the visual environment presented through virtual reality (VR) has been shown to be an effective way of invoking different postural responses as measured through body sway. Other research has been inconclusive about the effects of music on posture, and, to date, none have looked at the combined effect of music and VR motion on body sway. For this study, we hypothesized that music (manipulated to match VR motion) would promote postural instability. Ten subjects stood quietly for 60 s while viewing a virtual environment that either remained stationary, meaning it moved only in response to normal head movement, or translated approximately 10 m at a frequency of 0.1 Hz. Simultaneously, subjects listened to a sample of Mozart's Jupiter Symphony that was presented in each of four conditions: unmodified, filtered at 0.1 Hz, changing in loudness at 0.1 Hz, and changing pitch at 0.1 Hz. Body sway was assessed using a force plate to measure anterior-posterior and medial-lateral shifts in the center of pressure. Although body sway increased when viewing the moving scene as measured by significantly increased anterior-posterior excursions, RMS, average velocity, and peak velocity, addition of manipulated sound did not enhance body sway. Further studies are being conducted to examine whether having people view the moving scene as measured by significantly increased anterior-posterior excursions, RMS, average velocity, and peak velocity, addition of manipulated sound did not enhance body sway. Further studies are being conducted to examine whether having people stand on unstable surfaces and altering the frequency of the music manipulations will produce changes to body sway due to auditory cueing.

Mentor: Jefferson Streepey, Department of Kinesiology, School of Physical Education and Tourism Management, IUPUI
69. Nicotine Increases Streptococcus mutans Biofilm and Arginine Negates the Effect

Dawn R. Wagenknecht*, Elizabeth A. S. Moser and Richard L. Gregory

1Department of Biomedical and Applied Sciences, Indiana University School of Dentistry; 2Department of Biostatistics, IUSM & Richard M. Fairbanks School of Public Health

S. mutans is detected in diseased cardiovascular tissues and strains expressing collagen binding proteins (CBP) invade endothelial cells in vitro. Nicotine (NIC) increases S. mutans biofilm. Arginine (ARG) alters structure and adhesion of the extracellular polysaccharides (EPS). We investigated the effects of NIC and ARG on biofilm formation by S. mutansserotypes c and k strains (n=10,10) genotyped for CBP genes (cbm, cmn). S. mutans grown in tryptic soy broth with 1% sucrose (TSBS) was seeded into 96-well plates with and without NIC (4 mg/ml) and/or ARG (10 mg/ml) and incubated 24 hrs at 37°C, 5% CO₂. Biofilm mass (crystal violet staining) and metabolic activity (XTT assay) were measured. S. mutans (Syto-9) and EPS (dextran-Alexa Fluor 568) mass were quantitated by confocal laser scanning microscopy (CLSM). Two-way ANOVA with interaction and random effect for multiple measurements was used for statistical analyses. Biofilm and metabolic data required a rank-transformation prior to analysis. NIC, ARG and NIC+ARG had significant effects on biofilm mass and metabolic activity. Genotype affected biofilm mass (p=0.002). Genotype and serotype affected metabolic activity (p<0.0001). Biofilm mass and metabolism were greatest in cbm-/cmn+ strains. NIC increased bacterial but not EPS mass. More EPS was produced by cbm-/cmn+ strains than cbm+/cmn+(p=0.008) and cbm+/cmn-strains (p<0.0001). The effect of NIC on EPS was suppressed by ARG (p=0.006). NIC significantly increased S. mutans but not EPS mass in biofilm. The cmn+ strains produced more EPS than cmn-strains. Addition of ARG to toothpaste for smokers may negate NIC-enhanced biofilm production.

Mentor: Richard L. Gregory, PhD; Department of Biomedical and Applied Sciences, Indiana University School of Dentistry.

70. Cathodal Transcranial Direct Current Stimulation of Cerebellum Reduces Temporal Summation of Pain in Healthy Young Adults

Brandon Wind, Kelly M Naugle, Anthony Meek, Mutsa Godza, Zachary Riley

Department of Kinesiology, School of Physical Education and Tourism Management

Recent evidence shows the primary motor cortex (M1) and cerebellum play roles in endogenous pain inhibition. Transcranial direct current stimulation (tDCS) is a non-invasive brain stimulation technique capable of modulating excitability of cortical and cerebellar neurons. Several studies suggest tDCS as a possible clinical therapeutic agent. Anodal tDCS of M1 has been shown to improve pain inhibition, but little work has been done regarding the cerebellum. The purpose of this study is to expand upon this and study the effects of tDCS on pain inhibition in healthy young adults. 20 young adults were enrolled in this study. Six sessions were conducted on separate days with one of the following 15-minute experimental conditions each session: (1) anodal M1 tDCS, (2) cathodal M1 tDCS, (3) anodal cerebellar tDCS, (4) cathodal cerebellar tDCS, (5) Sham tDCS, (6) Control. Order of experimental conditions was randomly assigned for each subject. Dynamic quantitative sensory tests were used to assess pain inhibitory capacity before and after tDCS. Normally distributed data were analyzed with 3 (tDCS condition) x 2 (Time) ANOVAs, while abnormally distributed data were analyzed with nonparametric tests. Bonferroni corrections were applied to post-hoc tests. Results indicated that anodal (p=.008) and cathodal (p=.003) tDCS of the cerebellum significantly reduced ETS (p=.009). HTS was significantly reduced in all conditions. No significant differences were found for HPTs or CWB pain ratings. Further research using different intensities and durations is needed to determine the role of the cerebellum in descending pain inhibition.

Mentor: Dr. Kelly Naugle
Transcranial direct current stimulation (tDCS) is a non-invasive brain stimulation technique that has been applied to the motor cortex (M1) to facilitate learning of skilled, dexterous hand tasks. However, when there is a timing component to the motor skill, tDCS is usually applied to the cerebellum. The purpose of this study was to determine if M1 tDCS could improve performance of a motor skill that required dexterous finger movements and timing. 34 healthy adults (age: 22.8 ± 2.7) were randomized into either anodal (n=19) or sham (n=15) stimulation groups. The Step Mania game is a timing-based video game that involves pressing the correct arrow keys on a keyboard at specific times when scrolling icons overlapped on a computer screen. Each subject practiced the task at least two times to obtain a pre-practice score. Each key press corresponded to a time relative to the optimal key pressing time. This put each key press into bins corresponding to accuracy score. If the subject pushed the key optimally they were given a score of 1, and this score decreased as they were further away from the target (0.75, 0.5, 0.25, 0, and a complete miss, -1). Scores for each trial were an average of these numbers. Each subject completed ~2 minutes of practice followed by ~2 minutes of rest and repeated this 5 times for 20 total minutes of practice. Post-test scores were obtained 5 and 10 minutes following practice. During practice, tDCS electrodes placed over the M1 cortical area for the non-dominant hand and the contralateral supraorbital area delivered a current of 1mA in the anodal condition. Sham stimulation was applied according to established blinding procedures with a brief ramp in current followed by the current ramping back down. Gain scores (score – baseline) were calculated for each condition. Gain scores were similar for practice trials 1 and 2, but the anodal stimulation produced significantly greater gain scores during practice trials 3 and 4 (p=.047 and p=.043, respectively). Gain scores did not significantly improve across time with sham stimulation, whereas anodal stimulation resulted in significantly higher gain scores at both 5 minutes (p=.04) and 10 minutes (p=.04) post-practice. These results show that after the initial few trials subjects not receiving anodal tDCS did not continue to improve for the duration of the practice, whereas the anodal stimulation resulted in continued improvements. In the context of motor learning, within a single session, it appears that anodal tDCS paired with practice can be more effective than practice alone for a timing-based video game task.

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Transcranial direct current stimulation (tDCS) is a non-invasive brain stimulation technique that is used to increase (anodal stimulation) or decrease (cathodal stimulation) skilled motor performance depending on the polarity of the applied current. Most studies using tDCS have focused on simple hand and finger based motor skills such as pinch force tasks or tracing tasks, though it is unknown if tDCS can influence learning of more complex unilateral motor skills such as throwing. The purpose of this study was to examine how tDCS influences the acquisition of dart throwing skills with the non-dominant hand in healthy subjects. 58 subjects (age: 23.3 ± 3.9) were randomized into either anodal (n=20), cathodal (n=19), or sham (n=19) stimulation groups. The Edinburgh Handedness Inventory was used to determine their hand-dominance. Subjects completed a pre-test of throwing accuracy followed by 20 minutes of practice with concurrent tDCS (according to their randomized condition) and then a post-test. The task consisted of throwing darts at the center (bulls-eye) of a dartboard from a distance of 10 feet. Accuracy was measured as the distance of each throw from the center of the bulls-eye. Gain scores (score – baseline) were calculated for each quartile of the practice throws and the post-test. tDCS electrodes were placed over the M1 cortical area for the non-dominant hand and the contralateral supraorbital area. A current strength of 1mA was applied for 20 minutes in the anodal and cathodal conditions. Sham stimulation was applied according to established blinding procedures with a small ramp in current followed by the current shutting off. The results showed that anodal stimulation significantly improved performance between the first 25% and second 25% of practice throws (p < 0.001) and this improvement was maintained through the post assessment (p = 0.013). Cathodal and sham stimulation conditions showed no significant increase in gain scores across time. The gain scores for the anodal group were significantly higher than cathodal gain scores at the second 25% of practice (p = 0.036) and remained significantly better through the post-test (p = 0.03). There was a significant difference between the anodal and sham group gain scores in the last 25% of practice (p = 0.017) with the anodal group showing greater improvement. These results indicate that the acute application of anodal tDCS during a single short-term practice session can enhance the acquisition of a complex skilled motor task such as dart throwing whereas the sham stimulation condition did not show improvement with practice. The results were polarity dependent as well, since the cathodal stimulation appeared to block learning.
73. Contrasting Bone Phenotypes in the Different Mouse Models of Down Syndrome Suggests Trisomic Dyrk1a Does Not Act Alone

Sean Turner, Jared Thomas, Jonathan LaCombe, Eva Lana-Eloka, Sheona Watson-Scales, Elizabeth M. C. Fisher, Victor Tybulewicz, and Randall J. Roper
Department of Biology, Indiana University-Purdue University, Indianapolis, IN; The Francis Crick Institute, London, UK; UCL Institute of Neurology, London, UK

Down Syndrome (DS) is a genetic disorder in which there is a triplication of human chromosome 21 (Hsa21) causing skeletal abnormalities such as decreased bone mineral density (BMD), trabecular and cortical bone deficits. Trisomic mouse models recapitulate some skeletal and cognitive abnormalities associated with DS. Ts65Dn (~104) and Dp1Tyb (~148) are trisomic for gene segments found on mouse chromosome 16. Dyrk1a is found in three copies in individuals with DS as well as these mouse models, and is hypothesized to be involved in skeletal deficits. The aforementioned mouse models display similarities in many categories including deficits as compared to their euploid counterparts, but key differences in trabecular number and separation at sixteen weeks of age. Genetic normalization of Dyrk1a in otherwise trisomic Ts65Dn mice rescues some, but not all, skeletal deficits associated with DS. This suggests that there are trisomic genes in addition to Dyrk1a contributing to the abnormal bone phenotypes seen in DS.

Mouse models Dp2Tyb, Dp3Tyb, and Dp9Tyb combined share all the triplicated genes that the Dp1Tyb model contains but they are broken down into smaller segments. Dp3Tyb mice contain three copies of Dyrk1a whereas the Dp2Tyb and Dp9Tyb models do not. We hypothesize that Micro CT and three-point bending tests will provide the comparative data in trabecular and cortical BMD and mechanical strength to contrast the phenotypes displayed by these additional mouse models that contain different segments of Mmu16 in three copies. We expect to find that the Dp3Tyb model displays both trabecular and cortical deficits analogous to the Ts65Dn model but with less severity. This comparison may help explain which skeletal deficits are caused by trisomic Dyrk1a and which are caused by another mechanism.

Mentor: Randall Roper, Department of Biology

74. Analysis of the RD29A Cold-Regulated Promoter in Soybean and Arabidopsis.

Adib Behrouzi, Jennifer Robison, Stephen Randall
1Department of Biology, IUPUI School of Science

The inability of certain agriculturally important plants to tolerate extreme environmental conditions is a concern for the maintenance and improvement of food production. Previous work shows that the Arabidopsis thaliana promoter RD29A is responsive to a variety of abiotic stresses, and the RD29A gene is involved in cold-stress adaptation. The RD29A reporter construct (AtRD29A::GUS/GFP) was constructed and transgenically introduced into Arabidopsis thaliana (At) and Glycine max (Gm). Homozygous AtRD29A::GUS/GFP transgenic lines (four At and three Gm) have been identified. Examination of Arabidopsis seedlings showed GUS activity in trichomes, roots, and leaf tips. Tissue and organ expression during cold treatment of RD29A::GUS/GFP in a cold-tolerant plant (At) was compared to the cold-intolerant soybean plant (Gm). Lines of At and Gm were examined quantitatively at different time points in an assay using the substrate 4-methyl-umbelliferyl-β-D-glucuronide (MUG) with extracts of control (22°C) plants or plants treated for 2 days in the cold (4°C). The GUS assay showed a strong increase in cold-driven RD29A expression of GUS activity in both At and Gm. These data support the hypothesis that RD29A is cold-regulated in both Arabidopsis and soybean. Current research focuses on a quantitative analysis of cold induction of GUS activity inhomozygous transgenic soybean. This promoter will be a useful tool to help understand how cold tolerance occurs in cold-tolerant plants and may help determine cold-responses in intolerant plants such as soybean.

Mentor: Stephen Randall, Department of Biology, IUPUI School of Science, IUPUI

75. Which Away are the algae?

Theresa Hudson, Kathy Licht
Department of Earth Sciences, Indiana University Purdue University Indianapolis

In 2014 an IUPUI field group discovered a mat of unidentified, dried algae in Antarctica. Extremophile algae are well-documented in other parts of the continent but have not been previously described in this area. The site is around 1000 m in elevation and over 400 km from the edge of the closest ice shelf with an average temperature of approximately -30° C. The algal sample was found on the side of a 2 m high hillock covered in fragmented rocks with no evidence of ponded water in the area. Radiocarbon dating resulted in an age of 2,360 ± 30 14C years with δ13C -7.4‰. Examination with a stereoscopic microscope revealed that the algae forms convoluted, sheet-like structures. Further examination using a scanning electron microscope (SEM) shows possible filamentous cellular structure. The filamentous portions are of varying length (~10-20 μm) with diameters of approximately 1 μm. The overall structure of the sample is dominantly platy. This morphology is consistent with the structures produced by cyanobacteria. These preliminary observations reveal characteristics similar to Nostoc commune (a type of colonial cyanobacteria). A portion of the sample is currently undergoing genetic testing. The information procured by this testing may provide identification at the species level. If the sample is Nostoc commune, this area had liquid water when the specimen was alive. As global temperatures continue to rise, new occurrences of liquid water may increase around the continent. It is possible that this may allow microorganisms (e.g. algae) to populate previously “lifeless” locations.

Mentor: Kathy Licht, Department of Earth Sciences, Purdue School of Science, IUPUI
The stress response of low temperature can bring about an accumulation of late embryogenesis abundant (LEA) proteins in Arabidopsis thaliana. Although previous studies have shown that the accumulation of dehydrin proteins correlates with increased plant viability in the cold, no direct evidence has been found to demonstrate the requirement for dehydrins in cold tolerance. Single mutants in dehydrins have no visible impact on cold tolerance. In an attempt to produce an observable phenotype, a third dehydrin knockout, of ERD10, in a dehydrin double knockout background (erd14, cor47) Arabidopsis was implemented through a floral dip introduction of a plasmid containing desired guide RNAs and CRISPR Cas9. Plasmid uptake was screened by antibiotic resistance and resistant mutants were collected and harvested. The T7E1 assay will be used to identify mutations occurring in ERD10, using mismatched base pairing in the ERD10 location. This would indicate the uptake of the CRISPR construct and the potential knockout of ERD10. Plants containing the triple knockout will have created a novel mutation in Arabidopsis and can be used in stress experiments to study the phenotypic (cold) response caused by dehydrin knockouts.

Mentor: Stephen Randall, Department of Biology, Purdue School of Science, IUPUI
Session 2
12:45pm - 1:45pm
1. **Vergangenheitsbewältigung in Post-World War II German Cinema**

**Adam Fierst**

World Languages and Cultures; IU School of Liberal Arts

With the devastation of the Holocaust and the effects of a Third Reich dictatorship among its post-World War II challenges, Germany faced the difficult task of reconstructing a civil society. From this reconstruction came the notion of “Vergangenheitsbewältigung,” a word that roughly translates to reckoning with the past. Even today, Vergangenheitsbewältigung permeates many aspects of German society. According to German philosopher Theodor Adorno, Vergangenheitsbewältigung should involve a process of critical self-reflection rather than simply “work through its past.” My comparative research project argues that the notion of critical self-examination is especially prevalent in post-World War II German cinema. I will analyze how films in the 1940s and 1950s address key aspects of the social and political situation in post-war Germany compared to films in the 1970s that look at post-war Germany retrospectively. Though expressed differently in certain decades, my research will argue that Vergangenheitsbewältigung permeates German film regardless of the era. Combining my own analyses with reviews from previous critics, my poster will examine how films such as Die Mörder sind unter uns (1946) and Liebe 47 (1949) explicitly and implicitly address the fresh wounds of a recent war and the Holocaust through the cinematic lens. These films, I argue, proposed tolerance, cooperation, and resilience as ways to work through personal and national trauma. My study of later films such as Die Blechtrommel (1979) and Die Ehe der Maria Braun (1979), which were released in the era of New German Cinema in the 1970s, will analyze the retrospective nature in which German culture approached Vergangenheitsbewältigung. In these films, the aspects of World War II were not as glaringly obvious but were indeed still prevalent.

Mentor: Thorsten Carstensen, World Languages and Cultures, IU School of Liberal Arts, IUPUI

2. **Mapping the Oratory of Frederick Douglass**

**Peter Harrah**

1 Department of History, IU School of Liberal Arts at IUPUI; 2 IU School of Public and Environmental Affairs at IUPUI; 3 IU School of Public and Environmental Affairs at IUPUI; 4 Department of English, IU School of Liberal Arts at IUPUI; 5 IU School of Education

This project is a multidisciplinary study of Douglass's speaking tours throughout his long career as an abolitionist, human rights advocate, and politician. Our primary aim was data collection for which our research team sampled years from six decades, the 1840s to the 1890s. This was the time period in which civil rights leader Frederick Douglass toured the United States. The purpose of this study is to develop a spatial representation of the itinerary of Douglass's speaking engagements. This will provide insight into the changing daily lives and hardships faced by African-Americans during the Antebellum era, the Reconstruction era, and the post-Reconstruction era. This project was accomplished through digital humanities research methodologies regarding data curation from a wide variety of sources and identifying pertinent information including the sponsoring organization, audience composition, media coverage, speech topic, and mode of travel. Once the data was collected, we mapped the information to create the visual spatial representation of our research using Neatline and Omeka. The ability to analyze geographic data using GIS software will allow us to determine significant spatial patterns in Douglass's oratory as well as changes in those patterns from decade to decade. Furthermore, this project will be able to engage the public through the Omeka exhibit, allowing for interactive and self-exploration of Douglass's career as an activist. Mapping the Oratory of Frederick Douglass is our contribution to the growing field of public digital humanities and an opportunity for public engagement and student research to come together.

Mentors: John R. Kaufman-McKivigan, Department of History, IU School of Liberal Arts at IUPUI; Jeffery Duvall, Department of History, IU School of Liberal Arts at IUPUI; Owen Dwyer, Department of Geography, IU School of Liberal Arts at IUPUI; Caitlin Pollock, Digital Humanities Librarian, IUPUI University Library

3. **Structural Racism and the Impact of Deconcentration of Impoverished Peoples**

**Andrea Huff**

Department of Anthropology, IUPUI School of Liberal Arts

Alleviating poverty to improve quality of life has been a concern for much of American history. Since the 1960s, there has been a concerted effort to address the issue by dispersing communities with high rates of poverty, a policy known as deconcentration. The goal of such policies was to “break the cycle” of poverty through introducing these populations to more beneficial environments. Using a review of the literature concerning deconcentration efforts, I examine the impact of deconcentration efforts on the quality of life of the residents in these communities, highlighting the importance of social capital and social networks in truly decreasing the number of individuals in poverty. The outcome of my research shows that these policies enacted in the 1960s still have negative repercussions on communities, particularly those with a high minority population. Moving forward, anthropologists can play an important role in ensuring any future poverty policies involve the residents as shared stakeholders so that the policies provide a longer lasting benefit to these communities.

Mentor: Susan Hyatt, Department of Anthropology, IUPUI School of Liberal Arts
4. Are The BRICS Countries On The Decline?

**Don E. McCraig Jr.**, **Darrell E. Brown**
Department of Marketing, 2Department of Management, Kelley School of Business, IUPUI

The purpose of this research is to discover if the BRICS theory, which states that the BRICS countries (Brazil, Russia, India, China, and South Africa) will be the largest economies in the world by the year 2050, is still an accurate prediction after internal and external factors have created economic instability throughout each country. This research is a prediction of where the power balance will be in the next 34 years. These countries take up half of the world's population, and their combined GDP is roughly $16.6 trillion, which is 22% of the world's GDP. If even one of these countries' economies are experiencing instability, it has a ripple effect to many places around the world. This can already be seen with China's GDP growth drop from 7.3% to 6.9% in 2015. Because of this drop, China began to buy less commodities which affected countries such as Brazil and many countries in Africa. Brazil is facing political/social instability on top of having their worst recession in over three decades. Russia went into recession in 2014 which has reduced their GDP growth by 3.7% on top of experiencing political tension with other countries, and South Africa is being affected by lowered commodity prices, which is expected to lower their growth rate. Through data analysis, literature analysis, and the opinion of different experts in the field, a formulated prediction can be formed to confirm the notion that the countries that make up BRICS are no longer on their way to economic dominance by the year 2050.

**Mentor:** Darrell E. Brown, Department of Management, Kelley School of Business, IUPUI

5. Educational System in Germany Versus America's

**Joseph Mooar**
Department of World Languages and Culture (Program in German)

This poster presentation at the 2018 Research Day will focus on the German educational system and how it differs from the American model. The German school experience is one that exhibits several unique aspects that differ from that of the American school experience, such as the three-tiered system, fewer extracurricular activities, and a more academic-oriented curriculum. The poster will focus on the timeline of a German student studying in Germany, providing a look at the different branches of the German school system. Included in the project will be several interesting facts about the German school system, like how homeschooling is illegal in Germany. The project will also have different aspects of the schooling based upon the different state regulations in Germany. On the poster there will be key differences in American and German ideals between the two school systems. To engage the audience, my poster will include big questions that people will be free to answer, such as the topics of free education or a hierarchical schooling system, two aspects that are very prominent in Germany. I also plan to include some key German vocabulary, such as the different school types (Hauptschule, Realschule, Gymnasium). The goal of the research project is to understand some cultural differences between Germany and America. Other people who view this project will hopefully be able to gain that insight as well and realize just how unique different cultures can be.

**Mentor:** Dr. Thorsten Carstensen

6. 3D Printing of Metal Infused Filament

**Oyedotun Isaac Ayeni**, **Jing Zhang**
Department of Mechanical and Energy Engineering, Purdue School of Engineering and Technology, Indiana University-Purdue University Indianapolis

3D printers have gradually evolved from expensive tools available only to a few experts to low-cost machines accessible by everyone. There is consistent effort to build printers to the public, mainly because it represents the largest group of cheap and open-source printers available. The plastic filaments used consist of, e.g., poly lactic acid (PLA), acrylonitrile butadiene styrene (ABS), and polyvinyl alcohol (PVA). Nowadays, hybrid materials combining polymers with functional materials are also commercially available. Especially combinations of polymers with metal particles result in printed objects with interesting optical and mechanical properties. The mechanical properties of objects printed with two of these metal-polymer blends were compared to common poly (lactide acid) (PLA) printed objects. The objectives of this research project are to develop easy methods (like printer settings, nozzle, and bed temperatures) to print using metal filaments and sinter the printed object before conducting both tensile tests and bending tests. After all these processes, this 3D print metal will be recommended for minor component in machines which will help reduce the machine weight and the manufacturing cost.

**Mentor:** Jing Zhang
Introduction: Each year around the world, an estimated 15 million infants are born too early, or too small, and around 1 million of these babies die. Complications from premature birth, including hypothermia (inability to maintain normal body temperature), breathing problems, and feeding difficulties, are the leading cause of global newborn death. NeoWarm is a biomedical device designed to prevent hypothermia and facilitate Kangaroo Mother Care (KMC), a newborn care intervention recommended for premature infants in low/middle-income countries (LMICs), where incubators are scarce, and there is a shortage of health care workers. In prior User Design feedback sessions, African NeoWarm end-users requested additional vital signs monitoring. Our project aim was to evaluate the utility of complementary sensors for this NeoWarm use case, and explore transmission of data to an open-source app. Methods: Interdisciplinary student teams from engineering and informatics collectively performed literature reviews to map existing digital health tools and wearable/wireless sensor technology for detection of neonatal hypothermia and vital signs monitoring in premature babies. Each team independently evaluated design challenges for the existing solutions. BME students presented their recommendations for ECG, respiration, O2 saturation, and body temperature sensors, and utilized thermal imaging for use case evaluation and NeoWarm efficacy. Results: Affordable and potentially feasible wearable/wireless vital signs monitoring sensor solutions, which are also compatible, via Bluetooth integration, with the mobile Helping Babies Survive (mHBS) app, were identified. Conclusions: We have identified viable and affordable wireless/wearable sensor technologies for integration into NeoWarm, to expand functionalities related to vital signs monitoring of premature infants in LMICs.

Mentors: Dr. Sherri Bucher3, Dr. Saptarshi Purkayastha4, Professor William Combs1

8. A Framework for Social Media Sensing of Population Health

Alvaro Esperanca
Electrical and Computer Engineering, School of Engineering and Technology

Conducting large health population studies is expensive. For instance, collecting field information about the efficacy of health campaigns or the impact of a disease may require the involvement of a large number of health providers over an extended period of time and sometimes may not reach the target population. In fact due to the aforementioned difficulties, health related population statistics may be unavailable or lag behind by several years. Recently, social media networks have emerged as a source of sensory data for various aspects of social behavior. This source of information is used to drive marketing campaigns, conduct threat analysis and profile groups of individuals among numerous other applications. However, these applications are usually limited to specific case studies and do not provide a systemic approach to translating social media data into knowledge. In this paper, we propose a framework that can extract knowledge from social media networks in support of large scale health studies. The framework consists of an automated workflow designed to collect data from social media, filter the data based on a given geographical area and extract information relevant to the target hypothesis. The framework is demonstrated in the case of mortality and incidence of three chronic diseases, namely Diabetes, Asthma and Cancer. However, the utility of the proposed framework extends to other areas in the health sector as well as other sectors and can help automate data-driven hypothesis validation.

Mentor: Zina Ben Miled, Electrical & Engineering, School of Engineering & Technology
9. Inferring Trisomic Interactions in Down Syndrome Skeletal Phenotype using Dp9Tyb Mice


1Department of Biomedical Engineering, 2Department of Biology, Indiana University-Purdue University, Indianapolis, IN, 3The Francis Crick Institute, London, UK, 4UCL Institute of Neurology, London, UK

Individuals with Down syndrome (DS), a chromosomal disorder caused by trisomy of chromosome 21, display skeletal structure and strength deficits that lead to osteoporosis and heightened risk of fracture. It has been suggested that there is a sexual dimorphism in the skeletal changes associated with DS. Ts65Dn mice, the most commonly used DS mouse model with 104 trisomic genes, exhibit skeletal deficits similar to individuals with DS and have displayed the importance of the trisomic gene Dyrk1a in DS bone phenotypes. Dp1Tyb mice are trisomic for 148 genes, have no reproductive issues like Ts65Dn mice and may prove to be a more complete model of DS. We studied Dp1Tyb and control, male and female mice at 6 and 16 weeks of age and observed genetic and sex dependent changes in bone structure and strength. Dp9Tyb mice are engineered to have trisomy of 76 of the 148 genes found in Dp1Tyb mice, and do not have three copies of Dyrk1a. Dp9Tyb mice allow us to test if trisomic genes in this region (without the influence of Dyrk1a) are important in the genetic and sex-dependent differences in DS bone phenotypes. We hypothesize that trisomic APP found in both Dp1Tyb and Dp9Tyb mice, may contribute to the DS bone phenotypes due to its associated increase in osteoclasts that break down bone. Upon finding skeletal alterations in Dp9Tyb mice, we can look deeper into the effects of elevated APP, and refine our research into the interactions of trisomic genes causing DS skeletal phenotypes.

Mentors: Randall J. Roper, Department of Biology, IU School of Science and Joseph M. Wallace, Department of Biomedical Engineering, Indiana University-Purdue University at Indianapolis

10. DFT study of anisotropic mechanical properties of Li_{x}CoO_{2}

**Lingbin Meng**, Linmin Wu, Jing Zhang

Department of Mechanical and Energy Engineering, School of Engineering and Technology

Lithium-ion batteries have been widely applied in many fields in need of energy storage devices. In many kinds of lithium-ion batteries, lithium cobalt oxide (LiCoO2) has become a popular cathode material due to its excellent electrochemical properties. It is reported that the mechanical properties of LiCoO2 will degrade during the lithium deintercalation process, which result in high risk of failure. In this work, the anisotropic mechanical properties of LiCoO2 were systematically investigated using the Density Functional Theory (DFT). The Young’s modulus, bulk modulus, shear modulus and toughness are obtained by simulated stress-strain curves using DFT model. It is observed that the anisotropy is increasing with the decreasing of the concentration of lithium, which is explained by the weaker Co-O bond strength due to the increasing charge depletion in the bonding regions.

Mentor: Jing Zhang

11. Simulation and Apparatus Design for Dielectrophoresis to Remediate Brownfields

**Morgan Mitchell**, Peter J. Schubert

Department of Mechanical Engineering, Purdue School of Engineering and Technology

The purpose of this project is to use renewable energy to remove contamination from soil without extensive excavation. Using renewable energy will allow us to eradicate the contamination by concentrating it over the course of 40 days. Over the process of 40 days 1000m3 of soil will be cleaned and only 1m3 will be removed and destroyed. If successful, we will have a much more cost-effective and less damaging way to save soil and remove dangerous elements from contaminated soil and groundwater. Ultimately this will give people, in contaminated areas, restored access to clean water. MATLAB was used to create a simulation of the concentration of the dipole elements in the contaminated soil.

Mentor: Peter J. Schubert, Professor of Electrical and Computer Engineering, Director of the Richard G. Lugar Center for Renewable Energy, Purdue School of Engineering and Technology
12. Quantifying the Physical Properties of Bronze Metal
Laura Morales, Michael Golub, Pallavi Negi, Brandon Elsner, Joseph Warner, Kyle Whittaker
Purdue School of Science, Purdue School of Engineering and Technology Department of Engineering

We seek affordable metal printing techniques for fabrication and prototype needs. Bronze is a highly valued metal alloy with a multitude of uses such as weaponry, currency, and award-recognition. In this project, the tensile strength and hardness of Bronze printed with Polylactic Acid (PLA) are investigated and compared to that of casted metal. The way in which the physical properties of Bronze PLA are quantified is by High-Temperature Tensile Testing with a furnace as well as a Universal Testing Machine (UTM). Before doing any of this the Bronze PLA must be obtained. This is when the use of 3D printing comes in. Filaments of Bronze (as well as Copper and steel) metal are obtained and printed into a "dog bone" tensile bar that can be tested. A problem that was faced during the research was that since it is a metal sample, it was prone to oxidation. Oxidation, as has been seen in rusty cars or old power tools, occurs when the surface of a metal comes in contact with Oxygen and an electrolyte. In order to make sure that the metal samples did not oxidize, Carbon served as a way to prevent this by allowing the carbon to oxidize rather than the metal. Initial results seem to show that the PLA printed samples are slightly weaker than casted materials. However, this loss of strength can be repaired by using more material when making parts. The possibility of inexpensive metal fabrication opens doors for more and faster research and development when designing new instruments and devices.

Mentor: Michael Golub

13. Fatigue characterization of 3-D printed 15-5 stainless steel
Anudeep Padmanabhan, Jing Zhang
Department of Mechanical and Energy Engineering, Purdue School of Engineering and Technology

3D printing technology has pervaded the space that was occupied by conventional manufacturing processes. This research focuses on the fatigue characterization of 3D printed 15-5 stainless steel. This material has excellent corrosion resistance and high toughness, making it a highly versatile material used across several industries. Several samples are printed in different print directions for fatigue testing. A study on the microstructure of the fractured samples is also a part of this research. This will enable us to understand the limits and modes of fracture under cyclic loading.

Mentor: Jing Zhang

14. FTIR Characterization of Media via Metal Hole Array
Jesse Sherman
Department of Mechanical Engineering, IUPUI; Department of Biomedical Engineering, IUPUI

Complications remain in the detection and identification of circulating tumor cells (CTCs) in biological systems. Dr. Jong Ryu of the Mechanical Engineering Department at IUPUI and his collaborators are working to develop a novel technique to identify such CTCs using a metal hole array (MHA) and Fourier Transform Infrared Microscopy (FTIR). The MHA device consists of a three-by-three grid with each grid designed to have differences in pitch and length. Using FTIR, infrared radiation (IR) is passed through the MHA resulting in spectral transmission peak and wavelength characterizations specific to each of the nine grids. Preliminary analysis of media such as water and Dulbecco's Modified Eagle Medium (DMEM) with the addition of microbeads of sizes 4.5μm and 10μm under the MHA resulted in shifts of said characteristic peak intensities and wavelengths based on IR interaction with the media. Ultimately, the MHA in addition to FTIR analysis is expected to result in similar changes in peak intensity and wavelength when analyzing media containing cancer cells. In the near future, the MHA is expected to detect and identify cancer cells based on changes in IR characterizations resulting from cell diameter, surface proteins, and internal organelles.

Mentor: Dr. Jong Eun Ryu, Department of Mechanical Engineering, IUPUI
15. The Influence of Reflow Profile on the Thermal Fatigue Behaviors of BGA Solder Joint

Taylor Whitaker and Megan Miller

1Department of Biomedical Engineering, Purdue School of Engineering and Technology; 2Department of Mechanical Engineering, Purdue School of Engineering and Technology

When transporting electronic materials many changes occur electronically and environmentally. During this transportation process a cycling fatigue and temperature change is expected within the packaging. In the packing, solder joints are typically used to provide mechanical support and connections to the product. The solder used in the joints is an alloy that has become a major influence on their mechanical behavior. Due to this influence it is critical to study the changes of the microstructure under thermal fatigue and environmental changes. The two solders examined throughout this research include eutectic 63Sn37Pb and lead-free 95.5Sn4.0Ag0.5Cu. The importance of different microstructure was key in these experiments thus the cooling rate during the reflow process was controlled. In addition to controlling the cooling rate, a fatigue test was performed on four specimens; 63Sn37Pb fast cooled and slow cooled and 95.5Sn4.0Ag0.5Cu fast cooled and slow cooled. Upon analysis it is clear that the 63Sn37Pb specimens that experienced slow cooling rates had longer life than those that experienced fast cooling rates. The lead-free 95.5Sn4.0Ag0.5Cu solder showed the opposite results. To analyze the specimens finite element analysis was used to determine the main cause of failure and also the weakest, most vulnerable solder joint. The verification of the relationship between microstructure development and thermal fatigue reliability was done through SEM. In addition, the EDX was used to examine the phases within the solder alloy.

Mentor: Jong Ryu
Department of Mechanical Engineering, Purdue School of Engineering and Technology, IUPUI

16. Recycled and Household Plastic Suitability for Reuse via 3D Printing

Tanjimul Alam, Carolina Cardona, Dante Goss, Nicholas Lozier, Julian Strobel, Skye Tutino, Laura Luther
Mechanical Engineering, Purdue School of Engineering and Technology

The additive manufacturing (AM) community has identified the unique opportunity of using recycled plastic in extrusion-based methods. Notably, only about 25% of the plastic produced in the U.S. is recycled. The most ubiquitous plastic is polyethylene, particularly, high-density polyethylene (HDPE). However, no scientific efforts have reported its use in AM. The objective of this work is to find the optimal processing parameters to utilize virgin and recycled HDPE in material extrusion-based AM. To accomplish this objective, our work addresses two research tasks: (1) finding the optimal parameters in the extrusion of HDPE filament, and (2) finding the corresponding optimal AM parameters for fused deposition modeling (FDM). The composition of virgin and recycled HDPE is analyzed using a Fourier Transform-Infrared Spectroscopy (FTIR) (Nicolet Thermo Scientific). The filament is obtained from an extruder apparatus (Filafuser) and utilized to build FDM-processed test specimens according to the ASTM standard D638. The mechanical properties of the filaments and the test specimens are assessed by tensile testing (MTS Q-Test). For the same extrusion pressure, the optimal extrusion temperature of the recycled HDPE filament is found to be about 10°C higher than the one of the virgin counterpart. The elastic modulus is 1.80 GPa for both virgin and recycled HDPE filament with corresponding tensile strength values of 38 MPa and 24 MPa. Ongoing research includes the fabrication of tensile specimens and their mechanical characterization.

Mentor: Andres Tovar & Amanda Siegel

17. High Specific Energy LiNiP04/Graphene as Cathode Material for Lithium Ion Batteries

Collyn Dodge, Ebm John Daniel, Carolina Luna
Purdue University School of Engineering and Technology
Indiana University-Purdue University Indianapolis

Lithium Ion Batteries (LIB) are the cornerstone of today's technology. We have become dependent on energy storage devices in our everyday lives. Improving LIB's is the next major step towards the technology of tomorrow.

Lithium technology has dominated the portable battery industry. Now, lithium nickel phosphate along with graphene oxide, as batteries, seem to have a promising future due to their structure producing better conductivity. However, the current problem with these type of batteries is that they are unable to hold onto the charge they receive from an external source due to the fact that the chemical reactions involved are irreversible. This prevents the battery from discharging efficiently, thus causing a sudden drop in voltage.

We are testing different methods of synthesis to improve the electroconductivity of the batteries. Improving the conductivity will help solve the problems faced with the batteries not holding a charge. We are comparing multiple different solvents during the synthesis process to determine which has the best benefits. The following solvents were used: Ethanol, 1-methyl-2-pyrrolidinone (NMP), and Benzyl Alcohol, all mixed with a similar amount of deionized water.
18. Applying Custom Loading Waveforms to Emulate Natural Conditions

Michael A. Frye1, Alycia G. Berman2, Joseph M. Wallace1
1Department of Biomedical Engineering, Purdue School of Engineering and Technology, IUPUI; 2Weldon School of Biomedical Engineering, Purdue University

When cyclically loading materials, it is common to use simple waveforms (sinusoids, square waves, sawtooth waves, etc.). While these waveforms are sufficient to study material properties ex vivo, they are oversimplifications of typical physiological loading patterns. The purpose of this project was to modify a mechanical tester in order to better mimic the physiologically relevant waveforms that a bone and/or other biological materials would experience in vivo. To accomplish these modifications, the loadcell was modified to pass its output signals through an instrumentation amplifier and into a microcontroller. The host computer then sent the desired load signal to the microcontroller to be subtracted from the actual load signal, modifying the negative feedback control system employed to control the actuator. The modified signal was then output by the microcontroller and attenuated using operational amplifiers before being returned to the original path into the data acquisition system. This setup allows the user to input any type of waveform via the host computer. Current work is focused on developing a method for calibrating the load cell with the microcontroller to convert the signal into units of force. Additionally, the amplifiers need to be modified to handle both positive and negative voltages which appear in the load signals. Finally, the hardware and software need to be simplified for ease of use with a variety of load cells. Following the realization of these modifications, physiologically relevant and simple waveforms can be compared by loading tissue samples in vivo and examining morphological differences.

Mentors: Joseph Wallace, Department of Biomedical Engineering, Purdue School of Engineering and Technology, IUPUI; Alycia Berman, Weldon School of Biomedical Engineering, Purdue University

19. Characterization Of Tensile And Hardness Properties And Microstructure Of 3d Printed Bronze Metal Clay

Michael Golub, Jing Zhang
Mechanical and Energy Engineering, Engineering and Technology

Bronze is a popular metal for many important uses. Currently, there are no economical 3D printers that can print Bronze powders. A recent product, Bronze Metal Clay (BMC) has arrived. Additionally, commercial metal 3D printers require laser or electron beam sources, which are expensive and not easily accessible. The objective of this research is to develop a new two-step processing technique to produce 3D printed metallic component. The processing step includes room temperature 3D printing followed by high-temperature sintering. Since no material data exists for this clay, the tensile strength and hardness properties of BMC are compared to wrought counterpart. In this research tests are completed to determine the mechanical properties of Cu89Sn11 Bronze Metal Clay. The author of this thesis compares the physical properties of the same material in two different formats: 3D printed clay and molded clay. Using measured stress-strain curves and derived mechanical properties, including Young’s modulus, yield strength, and ultimate tensile strength, the two formats demonstrate inherit differences. The property differences between 3D printed, molded, and wrought samples was explained by examining their micro structures. It shows that 3D printed sample had more pores than the molded one due to printing process. This study demonstrates the flexibility and feasibility of using 3D printing to produce metallic components, without laser or electron beam source.

Mentor: Jing Zhang

20. Synthesis and 3D Printing of Zircon Ceramic Slurry

James Hickey, Dulus Owen, Jeremiah Rhoades, Jing Zhang
Department of Mechanical Engineering; Purdue School of Engineering & Technology, IUPUI

The field of 3D printing has revolutionized the manufacturing industry, allowing for the printing of plastics, metals, and ceramics. Though much innovation has taken place in the development for plastic and metal printing, little has taken place in the ceramics field. Ceramics are strong under compression and some are biocompatible, which are reason they are useful in biological implementations, such as bone scaffolding and crowns for teeth. The need for one-of-a-kind products is present in the medical, dental, and manufacturing field. The ability to produce these specialty items in-house will reduce cost and time. The goal for this year was to synthesize waste to synthesize Zircon ceramic powder into a viscous, self-supporting slurry and to convert a desktop 3D printer from an air-actuated extrusion system to a mechanically-actuated extrusion system. The Zircon ceramic is useful in the development of molds for metal casting. Complex molds can be created once the ceramic printing process is perfected. The conversion of the 3D printer should yield promising results, allowing for the production of better quality parts. In conclusion, the synthesis of Zircon ceramic slurry was successful, and modifications have been made on the desktop 3D printer, which are expected to yield favorable results.

Mentor: Jing Zhang
21. Hypoxia-Inducible Hydrogels via Enzyme-Immobilization

Britney Hudson1, Hung-Yi Liu2, Camron S. Dawes1, Chien-Chi Lin1,2
1Department of Biomedical Engineering, Indiana University-Purdue University; 2Weldon School of Biomedical Engineering, Purdue University

Hypoxia is the deficiency in the amount of oxygen reaching tissues. Oxygen level is critical in many aspects of cellular fate processes. Current methods for hypoxic cell culture include gas controlled chambers and microfluidic devices. However, these methods are expensive, time consuming, and therefore may not be readily available for many biomedical laboratories. To address these issues, we have recently developed enzyme-immobilized hydrogels as an easy and convenient way for creating solution hypoxia under ambient air. Specifically, glucose oxidase (GOX) was acrylated using acrylate-PEG-succinimidyl valerate (PEGA). Acrylated GOX was co-polymerized with poly(ethylene glycol)-diacrylate (PEGDA) through UV-light mediated photopolymerization. In this study, we investigated the effects of freeze-drying on oxygen-consuming activity of immobilized glucose oxidase. We further explored enzyme stabilization strategies to mitigate potential damages induced by freeze-drying process and the adverse effects of reaction by-product, hydrogen peroxide. Finally, the effects of immobilized-GOX induced hypoxia on 3D cell culture were evaluated using pancreatic ductal adenocarcinoma (PDAC) cells. We found that trehalose protected enzyme structure from damage due to freeze-drying. By-product hydrogen peroxide negatively impacts enzyme activity and addition of GSH mitigated this damage. These strategies allowed the GOXPEGAgels to induce extended solution hypoxia and hypoxic cell response. These results are essential to improving the enzyme-immobilized hypoxic hydrogel system for in vitro cancer cell study.

Mentor: Chien-Chi Lin, Department of Biomedical Engineering, Indiana University-Purdue University

22. Opportunistic Indoor tracking

Apeksha Jangam
Computer and Information Science

Opportunistic Indoor tracking is an area of immense importance. Tracking is an important activity which finds its use in location awareness and thousands of applications like GPS based on it. Indoor tracking is more challenging than outdoor tracking because of the degradation or loss of signals. The existing indoor tracking methods concentrate on using a primary modal system to do the detection of coordinates. In this project, our focus is on tracking process using RFID. The study is focused to determine the position of the object accurately and effectively. Another goal of this project is to determine the most effective algorithm to reduce the cost and the error. To achieve this, we have used linear regression model and k-nearest neighbor algorithms. To reduce the cost of the system number of RFID readers are reduced. Only one reader with passive reference tags in a specified topology. Another part of the project is to compare these topologies to see the better result.

Mentor: Rajeev Raje

23. An Accurate and Cancellable Facial Authentication Scheme

Tyler Phillips
Department of Computer and Information Science, IUPUI School of Science

In recent years, biometric authentication has become a part of everyday life. In particular, facial authentication is now employed in a wide range of domains where various levels of security and privacy are necessary. Unlike traditional authentication methods, once biometric credentials are stolen, they cannot be reasonably revoked and replaced. One answer to this issue has come in the form of cancellable biometrics. Cancellable biometrics are altered user biometrics which are used for recognition and authentication. This allows users to cancel compromised biometrics and then simply alter their biometrics differently in the future. Unfortunately, cancellable biometrics often present a trade-off between user privacy and system accuracy. One cancellable biometric scheme, the BioCapsule scheme, has been proposed by researchers from Indiana University-Purdue University Indianapolis. In this poster, we detail the BioCapsule scheme and its security benefits. Next, we display the accuracy effects of embedding the BioCapsule scheme into a texture-based facial authentication system. Finally, we show the effects of embedding the BioCapsule scheme into a deep learning facial authentication system. Through these comparisons, we demonstrate the BioCapsule scheme’s ability to preserve user privacy, while at the same time having minimal effects on underlying system accuracy.

Mentor: XuKai Zou
The emergence of electronic health records has contributed to an abundance of clinical data that could be analyzed to promote health outcomes and eliminate health disparities. However, the effectiveness of electronic health records in reducing health disparities has yet to gain momentum as they do not contain data on social determinants of health that are important for health disparities research. Linkage to external data sources and community information systems are often necessary. For Marion County, Indiana, clinical data from the Indiana Network for Patient Care and community health data from the Social Assets and Vulnerabilities Indicators will be merged together to determine where the greatest areas of health disparities exist while adjusting for several different social determinants of health for the disease chlamydia. Multiple spatial analytical methods such as the hot-spot analysis, geographically weighted regression, and Gini inequality indices were performed to measure the degree of health disparity. Results show that chlamydia rates are not uniformly distributed throughout Marion County with the highest rates occurring at the northern border of Central and Warren township. Furthermore, the social determinant of single female household has the greatest impact on chlamydia rates at the northeastern part of Marion County. The outcome of this research will lead to more effective methodologies in identifying disease risk patterns for an affected area. Additionally, public health professionals can use spatial analytical tools to better facilitate the needs of the community and to allocate necessary resources in these locations.

Mentors: Josette Jones, School of Informatics and Computing, Indiana University; Brian E. Dixon, Richard M. Fairbanks School of Public Health

25. Matrix stiffness affects metabolic signaling and proliferation in breast cancer cells

Chuanwei Ye, Sungsoo Na
Department of Biomedical Engineering, Purdue School of Engineering and Technology

Cancer metastasis is a primary cause of cancer-associated mortality. It is well known that breast cancer cells can be metastasized to bone, where they grow and become a secondary tumor. While AMP-activated protein kinase (AMPK) signaling plays a crucial role in cell growth and cancer progression, it can function as a cancer promoter or cancer suppressor in a context-dependent manner, which makes it difficult to determine the role and mechanism of AMPK on cancer cell homeostasis and growth. In this study, we visualized compartmentalized AMPK signaling activity in different subcellular locations in response to extracellular matrices of which stiffness values are similar to those of epithelial tissues (primary tumor) and pre-calcified tissues (secondary tumor). We observed that breast cancer cells and normal epithelial cells have distinct AMPK activity under different matrix stiffness. Cancer cell proliferation was also dependent on matrix stiffness. During this spring, we will continue to work on this project to examine the correlation between compartmentalized AMPK activity and cell proliferation.

Mentor: Sungsoo Na, Department of Biomedical Engineering, Purdue School of Engineering and Technology, IUPUI

26. Comorbidity of Stress and Voluntary Alcohol Consumption in Male and Female Wistar Rats

Brittany Bogan, Sean Gainey, & Marian Logrip
Psychology Department in the Purdue School of Science

Alcohol use disorders (AUD) and stress-related disorders like PTSD impact millions of people a year, and women are more susceptible to stress. In rodents, females often drink more than males, but also show greater stress susceptibility to individual, rather than paired, housing. To explore the roots of sex differences in the comorbidity of stress and high alcohol intake, we analyzed male and female voluntary drinking patterns through an intermittent access 2-bottle choice paradigm, with and without a cage partner, to test effect of stress history and housing conditions on the development of binge-like drinking patterns. Alcohol intake and preference after 1 and 24h were recorded over 8 weeks and changes in drinking assessed after a 2-week abstinence period. Anxiety-like behavior during abstinence was quantified with the defensive withdrawal test. Alcohol intake and preference escalated in males regardless of housing conditions, a behavior that was not been seen in females. Females did not escalate drinking over time but tended to show greater relapse-like intake increases. Stress history rats showed greater reluctance to leave the covered beaker and enter the open field during defensive withdrawal, and spent more time overall inside the beaker. We also tested whether MP-10, an inhibitor of phosphodiesterase 10A, would reduce alcohol drinking in a stress-specific manner, but instead found it reduced drinking in a dose-dependent manner, regardless of sex or stress history. These data show differences in male and female drinking patterns, stress effects on drinking, and anxiety-like behavior that may be affected by housing conditions.

Mentor: Dr. Marian Logrip
27. Characterization of a Sulfate Transporter, a Putative Substrate of the Calcium Dependent Protein Kinase 3 (CDPK3) in Toxoplasma gondii

Moses Leon Darkey, Raj Gaji, and Gustavo Arrizabalaga
Department of Pharmacology and Toxicology; Indiana University School of Medicine, Indianapolis, Indiana, USA 46202

Toxoplasma gondii is one of the most widespread protozoan parasites of warm-blooded animals. T. gondii causes diseases in immunocompromised humans as well as people infected congenitally. Most of the pathogenesis associated with Toxoplasma infection is due to its propagation cycle, which includes invasion into the host cell, replication, and lysis of the host cell by a process called egress. Previous studies from our lab and others have shown that Calcium Dependent Protein Kinases (TgCDPK3) is a key regulator of Toxoplasma egress. To determine the mechanism of function of TgCDPK3, we performed proximity labeling assay named BioID to determine the putative substrates of this kinase. Among these, is a sulfate transporter domain containing protein TgGT1_313020. To determine the localization of this anion transporter, we engineered a tagged the 3' end of the gene with an HA epitope tag followed by immunofluorescence analysis using anti-HA antibody. Results revealed that the protein localizes to the parasite plasma membrane just like TgCDPK3. Further, immunoblot analysis of the parasite clone stably expressing the HA tag revealed a single band around 110 kD that is about the expected size of this protein. As TgGT1_313020 interacts with TgCDPK3 based on BioID, and it is also localized to the parasite's plasma membrane, we hypothesize that this sulfate transporter is a substrate of TgCDPK3. Towards this goal, efforts are underway to generate null mutants of this gene and characterization of these null mutants regarding intracellular transport and egress.

28. Subjective Sleep Quality and Pain Catastrophizing are associated with Chronic Post-Traumatic Headache in Mild Traumatic Brain Injury Patients

Jason Hackett1, Christopher Carey, MS1, Jonathan Saxe, MD2, Fletcher A White, PhD2,3, Kelly M Naugle, PhD1
1Indiana University Purdue University Indianapolis; 2St. Vincent's Health System, Trauma Department; 3Indiana University School of Medicine

Chronic post-traumatic headache (mTBI) is one of the most debilitating and long-lasting consequences of mild traumatic brain injury (mTBI). Sleep quality is a consistent risk factor for negative pain experiences. Therefore, the purpose of this study was to compare subjective sleep quality and pain catastrophizing between mTBI patients with chronic PTH (mTBI/PTH+), mTBI patients without chronic PTH (mTBI/PTH-), and matched controls (mTBI and headache free). Twenty-five mTBI patients (mTBI/PTH+: n=12; mTBI/PTH-: n=13) completed a study session approximately 4-months post head injury. Twenty-one participants who were mTBI and headache free and age-, gender-, and race-matched to mTBI patients served as the control group. Participants completed the Pittsburgh Sleep Quality Index (PSQI) which assessed sleep quality over the past month and includes 7 component scores. Participants also rated the average intensity of headache pain using a 0-100 numeric rating scale and completed the Pain Catastrophizing Scale (PCS). One-way ANOVAs were used to determine group differences in PSQI total and subcomponent scores and PCS. The mTBI/PTH+ group reported worse quality of sleep compared to the mTBI/PTH- and control groups, as demonstrated by differences on the total PSQI score (p<.001) and the component scores of sleep disturbance (p<.001), daytime dysfunction (p=.008), and sleep efficiency (p=.004). The mTBI/PTH+ group also reported greater PCS compared to the mTBI/PTH-group (p=.032). Mild TBI patients with chronic PTH’s reported poorer sleep quality and greater pain catastrophizing compared to mTBI patients without headaches and controls.

Mentor: Kelly Naugle

29. The Effect of High Bone Mass on Orthodontic Tooth Movement

Robert Holland*, C. Bain, R. Alrasheed, A. Robling, A. Utreja (Indiana University School of Dentistry)

The Low-density lipoprotein receptor-related protein 5 (Lrp5) is a co-receptor of the Wnt cell signaling pathway, that is a crucial regulator of bone homeostasis. Overexpression of Lrp5 leads to a high bone mass (HBM) phenotype in mice. As alveolar bone remodeling is an integral part of the response to an orthodontic force, the objective of this study was to analyze the effect of Lrp5 overexpression on orthodontic tooth movement (OTM) in Lrp5-HBM mice. Materials and Methods: Two genetic variants of the Lrp5-HBM mice (A214V and G171V) and C57BL/6 wildtype mice were included in this study (n=16/group). The maxillary first molar on the right (experimental) side was tipped mesially by applying an orthodontic force with a closed-coil NiTi spring for 3 weeks. The tissues were then scanned for micro-CT analyses and processed for histology. Immunostaining for Lrp5 and sclerostin (Sost), and tartrate resistant acid phosphatase (TRAP) staining for osteoclasts were performed. The results were quantified in a predefined region of interest (ROI) in the furcation area of the maxillary first molar, and compared statistically between the groups. Results: Micro-CT analyses showed a significant decrease in the rate of orthodontic tooth movement in the Lrp5-HBM mice compared to the wildtype group (P<.05). Both HBM groups had higher percent bone volume (BV/TV), lower bone surface/volume ratio (BS/BV) and increased trabecular thickness (Tb.Th) compared to the WT group (P<.05). Histological analysis showed increased Lrp5 immunostaining in the PDL in both HBM groups compared to the WT group. Sclerostin expression was increased overall and decreased on the tension side in both HBM groups. Conclusions: Overexpression of Lrp5 decreases the rate of OTM in an animal model. Understanding the Wnt signaling pathway components involved in OTM can lead to more predictable orthodontic treatment outcomes in the future.
30. Determining the Role of Rpn4 in the Formation of HMWCs

**Brett M. Hopf**1, Lindsay J. Hammack1, Dilraj Panfair1, and Andrew R. Kusmierczyk1

Department of Biology; Indiana University-Purdue University Indianapolis

Proteasome formation is a highly regulated stepwise process in both yeast and humans. Proteasomes are important drug targets in the treatment of a number of cancers because they regulate many of the short-lived proteins that function to regulate the cell cycle. Yeast provide an ideal model organism for research on the effects of Rpn4’s role, which is an extremely important protein active in the control of proteasome levels in the cell. This research project was aimed at furthering our understanding of the role that Rpn4 plays in the formation of high-molecular weight complexes. The deletion of a copy of Rpn4 should have an observable effect on the amount of Rpn4 produced, which should then have an identifiable effect on the high-molecular weight complexes formed by the cell. These effects were identified by their phenotypes and through a high copy suppressor screen.

Mentors: Andrew R. Kusmierczyk, Department of Biology, IUPUI; Lindsay J. Hammack, Department of Biology, IUPUI; Dilraj Panfair, Department of Biology, IUPUI

31. Analysis of 16-Week-Old Dp1Tyb Mice Femurs Suggests Sex Dependent Skeletal Effects of Down Syndrome

**Adam Knox**1, Jared Thomas1, Jonathan LaCombe1, Eva Lana-Elola3, Sheona Watson-Scales3, Elizabeth M. C. Fisher4, Victor Tybulewicz3, Joseph M Wallace2 and Randall J. Roper1

1Department of Biology, Indiana University-Purdue University, Indianapolis, IN; 2Department of Biomedical Engineering, Indiana University-Purdue University, Indianapolis, IN; 3The Francis Crick Institute, London, UK; 4UCL Institute of Neurology, London, UK

Down syndrome (DS) is the most common trisomic chromosomal disorder in humans, resulting from three copies of human chromosome 21 (Hsa21) and occurs in about 1 out of 700 US births. Triplication of Hsa21 results in up-regulation and down-regulation of Hsa21 genes, not always consistent with 1.5 gene dosage level, as well as genome-wide dysregulation of transcription. This dysregulation results in varying symptoms but this study focuses on the impact of Down syndrome on the appendicular skeleton. DS in humans results in lower bone mineral density as well as higher incidence of bone fracture, osteopenia and osteoporosis. Possible explanations for these conditions include differences in activity level and diet, improper hormone balance (hypothyroidism), and genetic dysregulation that directly impacts skeletal development and bone homeostasis. This study aimed to further our understanding of how trisomy of key Hsa21 genes correlates with DS bone phenotypes. This was investigated using micro-CT to analyze femurs of the 16-week-old Dp1Tyb mouse model of human DS, which exhibits trisomy of ~148 homologs of Hs21 genes. Key findings were that male Dp1Tybas compared to euploid mice exhibited significantly lower bone mineral density, trabecular thickness/number, and cortical area. Female Dp1Tyband euploid as compared to male mice had inferior mineral density and trabecular parameters, and female trisomic mice had reduced overall cortical parameters. These data are important because they suggest trisomy causes architectural changes that correlate with weaker bone, and that these changes are sex dependent.

Mentor: Randall Roper, Department of Biology, Indiana University-Purdue University Indianapolis

32. Suppression of Neuroinflammation in Alzheimer’s disease by Unique Glucocorticoid-induced leucine zipper (GILZ) analog

**Niloy K. Lahiri**1,2, Mythily Srinivasan2,3, Anish Thyagarajan2, Debra Hickman4, and Debomoy K Lahiri2,5

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Alzheimer’s disease (AD) is a progressive neurodegenerative disorder with loss of memory and cognition. AD is characterized by brain deposition of neuritic plaques and neurofibrillary tangles. Aging and increasing stress are significant risk factors for AD. Stress-induced glucocorticoids accelerate beta-amyloid (Aβ) plaque formation and tauphorpylation, aggregates of which upregulate reactive oxygen species in vulnerable neurons. Metabolites of oxidative stress negatively regulate glucocorticoid receptor. This prevents nuclear translocation and suppression of the transcriptional factor, nuclear factor-κB (NF-κB) by glucocorticoids. The ensuing inflammatory distress enhances further Aβ accumulation initiating a vicious cycle. Glucocorticoid-induced leucine zipper (GILZ) protein mediates many of the cellular effects of glucocorticoids. Exogenous GILZ ameliorated disease in models of chronic inflammation. GILZ inhibits NF-κB by binding the p65 subunit of NF-κB in the cytoplasm and thereby preventing transactivation of inflammatory and apoptosis mediators. Microglial GILZ expression correlates negatively with inflammatory cytokines. Increased p65, upregulated inflammatory cytokines and apoptotic markers are observed in postmortem AD brain tissues. Therefore, selective targeting of activated p65 is an attractive strategy to modulate neuroinflammation and suppress neurodegeneration. Recently we have reported the design and functional potential of structural analogs of GILZ that selectively blocked activated p65 and suppressed Aβ-induced cytotoxicity in human mixed brain cell cultures. Here we evaluated the efficacy of GILZ mimics in lipopolysaccharide induced neuroinflammation model and in the 5XFAD animal model of AD. Our data suggest that mice treated with select mimics of GILZ exhibited better cognition, reduced inflammation and Aβ deposits suggesting a therapeutic potential for AD.

Mentor: Dr. Mythily Srinivasan
Cigarette smoking, the most common form of tobacco product addiction, exposes the oral cavity of smokers to nicotine both during the act of smoking and for an extended period of time afterwards. Numerous studies have revealed a positive correlation between smoking and an increased incidence of dental caries. Nicotine has been consistently shown to enhance planktonic growth and biofilm formation of Streptococcus mutans, a facultative anaerobic oral bacteria that is the key contributor to the formation of dental caries, at physiologically relevant concentrations –between 0.25 and 4.0 mg mL⁻¹. The major metabolic pathway of nicotine, the N-demethylation pathway, has been studied in several different animal models and is generally well understood. In this pathway, nicotine is broken down into a series of intermediates ultimately producing norcotinine. The objective of this study was to identify how each compound actively broken down from nicotine through the N-demethylation pathway influenced the biofilm formation and the kinetic growth of S. mutans. The UA 159 strain of S. mutans was exposed to nicotine as well as the intermediates found within this metabolic pathway –norcotinine, nornicotine, cotinine, and trans-3'-hydroxycotinine –at physiologically relevant concentrations (0.125, 0.25 and 0.5 mg mL⁻¹). Each treatment was analyzed via crystal violet staining for biofilm formation and direct spectrophotometric kinetic growth analysis. Norcotinine, the final compound in the N-demethylation catabolic pathway of nicotine, significantly decreased (p<0.05) the biofilm formation and kinetic growth of S. mutans. At a concentration of 0.5 mg mL⁻¹ norcotinine, biofilm formation was completely inhibited.

Mentor: Dr. Richard L. Gregory, Department of Applied and Biomedical Sciences, Indiana University School of Dentistry

34. Maternal Liver Turnover and Adaptations during Pregnancy

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Abstract: Evidencesuggests that pregnancy induces widespread adaptations in vast majority of maternal organs. However, this area of research is largely unexplored. We previously demonstrated that maternal liver exhibits robust growth and marked changes in gene-expression profile. This study aims at investigating the cellular and molecular mechanisms underlyinig this phenomenon. To determine whether cell proliferation is a generalized phenomenon in maternal organs, we exposed pregnant C57BL/6J mice to BrdU throughout gestation. We found that, maternal liver and pancreas displayed massive BrdU incorporation, whereas other organs examined did not. Prior to parturition, ~60% of maternal hepatocytes and pancreatic acinar cells underwent DNA replication, indicating that pregnancy inducesturnover in a small subset of maternal organs. To determine the source of newly generated maternal hepatocytes, we generated two in vivotracing mouse models. We found that pre-existing hepatocytes drives maternal liver turnover. Strikingly, maternal hepatocytes express CD133 and α-fetal protein, which are hepatoblast molecular markers, suggesting that maternal hepatocytes adopt a unique phenotype or possibly undergo dedifferentiation. Hippo/YAP pathway is known to controlorgan growth and YAP activation induces hepatocyte dedifferentiation. Surprisingly, we found that the components of this pathway are disconnected and nuclear YAP amounts kept constant in maternal hepatocytes throughout gestation. However, cytoplasmic YAP amount showed a dynamic changea as pregnancy progressed. This suggests that YAP may act in hepatocyte cytoplasm via protein-protein interactions. Currently, we are further elucidating a gestation-dependent role of YAP in maternal liver. Our work is uncovering a unique and novel aspect of maternal liver physiology.

Mentor: Guoli Dai, Department of Biology, Purdue School of Science, IUPUI
35. UV Nucleotide Binding Site Photocrosslinking of Antibodies at Various Light Intensities

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The nucleotide binding site (NBS), found in the Fab variable domain of all antibody isotypes, is utilized in UV photocrosslinking methods for site-specific functionalization of monoclonal antibodies. UV exposure (254nm) to a small molecule, indole-3-butyric acid (IBA), that has high affinity to the NBS can be used to photocrosslink ligands to antibodies. Here, we propose a method to modify antibodies by photocrosslinking with various intensity UV light sources: UV crosslinker XLE-1000 (40-watt), handheld EF-160C (6-watt), and MiniMax UV-5NF (5-watt). The different UV sources possess different power levels and by modulating both time of UV exposure and distance from source site-specific crosslinking at the NBS, for affinity tags (IBA-Biotin) and fluorescent molecules (IBA-FITC) was optimized. Application of the UV-NBS photocrosslinking technique is possible by first incubating the FDA approved antibodies, Rituximab [chimeric anti-CD20] and Tocilizumab [chimeric anti-IL-6R] (12-15μM), with IBA-FITC (300μM) followed by 0.1-1.5J/cm² of UV exposure in triplicate experiments. Conjugation efficiency was determined via absorbance/fluorescent measurements for the quantity of conjugated IBA-FITC. The UV-NBS technique is a reproducible method of photocrosslinking antibodies. Optimization of UV energy exposure resulted in an increase of conjugations per antibody with maximized photocrosslinking efficiency, while antibody antigen binding activity and Fc recognition were preserved. This study demonstrates that the UV-NBS site-specific antibody modification technique can be accomplished using UV light sources with differing light intensities expanding its implementation potential through making the technology more accessible. Ultimately, the UV-NBS method is an efficient, practical, and accessible method of functionalizing antibodies in diagnostic, pharmaceutical, and therapeutic settings.

Mentor: Nathan J. Alves, Department of Emergency Medicine, IU School of Medicine, Department of Biomedical Engineering, Purdue University

36. Interpreting Developing Results of the Human Connectome Project

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The Human Connectome Project (HCP) is designed to promote understanding of neural connections and pathways throughout the human brain. Recently, this technology has been applied to individuals with early phase psychotic illnesses, such as schizophrenia. Importantly for the current project, a part of this study is to characterize a sample of individuals in the early phase of psychosis in terms of their symptom profiles. Two categories of symptoms were assessed using the Positive and Negative Syndrome Scale (PANSS), a gold standard measurement tool commonly employed in the study of psychosis. Positive symptoms are those that occur beyond ‘normal’ experiences, including things such as hallucinations and delusions. Negative symptoms are those that reflect reduced sensory or emotional experiences, such as lack of motivation or an inability to experience pleasure. The goal of this research project was to examine and report symptom data gathered thus far as a subset of the HCP study of early phase psychosis. Implications for how this data can aid in the determination of illness severity will be discussed. Throughout the duration of the project, patient visits were observed to help gain a better understanding of the use of the PANSS, as well as provide clinical examples of positive and negative symptoms.

Mentors: Jenifer L. Vohs, Department of Psychiatry, IU School of Medicine; Megan Gaunnac, Psychiatry, IU Psychotic Disorders Program; Andrew C. Visco, IU Psychotic Disorders Program
37. Determining the Residues that Mediate Angiomotin Coiled-Coil Homology Domain Vesicle Fusion Activity

Seth Sears

Angiomotins (Amot) are a family of adaptor proteins that control cellular signaling responsible for cellular differentiation and proliferation. These cellular events have been linked to regulation of invasive ductal carcinoma, the most common form of breast cancer. Their characteristic coiled-coil homology (ACCH) domain is of particular interest because of its capability to selectively bind phosphatidylinositol lipids (PI). These binding events subsequently lead to lipid membrane deformation and juxtanuclear endosomal vesicle fusion to the apical membrane. Our library of arginine and lysine residue mutations in the ACCH domain were screened for a loss of vesicle fusion activity. The mutations at the following residues led to a diminished fusion activity: R40T, K49E, K72E, K76E, R85T, R103G, K111E, K126E, K136E, K187E, R140S, R221Q, R224E, and R234G. Next, we endeavored to characterize how each of these residues participated in vesicle fusion by determining the kinetic rate of vesicle fusion. In this study, fluorescence resonance energy transfer between probes from 2 different lipid populations as a function of incubation time and protein concentration was utilized to determine the rate of fusion. Careful analysis of this data will provide insight into the ACCH domain structural elements that drive membrane fusion events.

38. Skeletal Abnormalities Exhibit Sexual Dimorphism in Down Syndrome Mice

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Down syndrome (DS), caused by a triplication of human chromosome 21 (Hsa21), is characterized by a spectrum of phenotypes including cognitive and skeletal deficits. Sexual dimorphism in skeletal deficits have been hypothesized in individuals with DS, however differences in age, methodology and tissue have impacted interpretation of these results. The Ts65Dn mouse model exhibits skeletal phenotypes associated with DS. Ts65Dn has some limitations including genetic composition (~104 orthologs on Mmu16) and exclusion of female mice in previous studies. Another model of DS, Dp1Tyb, was developed that has a duplication of all the Hsa21-orthologous regions on Mmu16 (~148 genes). Dp1Tyb has been hypothesized to have phenotypes more similar to DS because they have more orthologous genes at dosage imbalance and can be utilized to examine sexual dimorphism of DS traits. We hypothesized that there will be a difference in the skeletal deficits between male and female mice at 6 and 16 weeks. Male and female bones were subjected to three point bending test at both time points to determine bone mechanical integrity. There was a main effect of sex and genotype on whole bone and material-level properties. In addition, there was an interaction of age and genotype for Dp1Tyb mice for both pre-yield and post-yield properties. This suggests that with an increase in age, trisomic mice have weaker bones compared to their euploid counterparts. Overall, it appears that male mice have stronger bones in comparison to female mice across age and genotype.

39. The Effects of RAGE inhibition in Mice and Bone Resorption

Sinai Valdez, Hannah M. Davis, and Lillian I. Plotkin

School of Science Biology Department

Osteocytes, cells embedded in fully formed bone, are the key regulator of bone turnover by controlling the function of bone-forming (osteoblasts) and resorbing cells (osteoclasts) (Burr & Allen, 2014). Research from our lab previous works indicates a very specific gap junction of proteins called connexin43 was observed to be an important component of the signaling pathway controlling osteocyte survival (Plotkin, 2016). Further, aging decreases connexin43 then the deletion of this protein was found to mimic the skeletal phenotype of old mice (Plotkin, 2016). Prevalous studies have shown that HMGB1, a pro-inflammatory cytokine, mediates osteoclast recruitment/differentiation (Plotkin, 2016). The data collected so far further confirms the role of apoptotic osteocyte-derived HMGB1 in stimulating osteoclast differentiation evidenced by the decreases in osteoclast number/bone surface in young and old animals treated with the RAGE inhibitor. Through these studies we hope to further understand the molecular signals that link osteocyte apoptosis and osteoclasts recruitment/differentiation in aging. A previous experiment was designed to determine the molecular signals responsible for mediating these effects in mice lacking osteocytic Cx43 and in old mice (Plotkin, 2016). In order to address this problem we injected mice with a small molecule RAGE inhibitor in order to prevent HMGB1-RAGE activation since RAGE activation has been shown to induce an inflammatory response, forth the first part of my project will work to quantify the number and population of white blood cells in blood smears collected from young and old vehicle and treated mice. Researching the gap junctions and learning about connexin43 intriguing me in learning about more communication methods. Overall my project will be to examine the effects of RAGE inhibition in old mice and determine the effects this has on the aging skeleton filling the gap in another communication between bone cells. The hypothesis and expected results for this project is that apoptotic osteocytes release HMGB1 that then activates the RAGE receptor on osteoclasts and stimulates for osteoclast recruitment and activation of bone resorption.
40. Managing Esthetic Complications with Digitally Fabricated Complete Dentures

**Sultan E. Ainoosah**, BDS. Hussain D. Alsayed, BDS, MSD. John A. Levon, DDS, MS. Dean Morton, BDS, MSD Indiana University School of Dentistry

With the emergence of Computer Aided Design and Computer Aided Manufacturing technology, digital designing and milling of the removable complete denture prosthesis is highly beneficial. However, esthetic complications may occur involving the shape and/or shade of the teeth and with the amount of gingival display. A 66-year-old female patient presented with a digitally fabricated maxillary complete denture that was made 6 months ago. Her chief complaint was: “I don’t like how my upper teeth look like, my teeth are very long and I don’t show much of the gingival color.” Clinical assessments of the occlusal vertical dimension, centric relation, and phonetics revealed sufficiently fabricated dentures. However, the maxillary teeth were very long and the patient didn’t show enough of the pink acrylic resin. Since the location of the incisors edges were accurate. Gingival wax up was made on the existing denture to mask the cervical areas of all the maxillary teeth and it was given to the patient overnight on a “trial” basis. After 24 hours, patient came back happy and satisfied. The corrected maxillary complete denture was scanned and a new maxillary complete denture was milled. Finally, the denture was minimally adjusted and delivered to the patient. Patient was seen for the follow up, at which time she expressed her satisfaction with the overall results. Although the process of fabricating digitally designed removable complete denture is clinically predictable, there are drawbacks that require an alternative approach to excellently satisfy patients entreat and desire.

41. Effectiveness of Yoga and Stress Relaxation Elective Courses on Stress and Anxiety in College Students

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Studies have shown that a four-week practice of yoga lowered the aggression in adolescent students. K-12 schools have incorporated programs to help students overcome learning disabilities, lower behavioral problems, abilities to complete tasks, and increase learning and academic performance, very few studies have targeted college populations. The purpose of this study was to evaluate whether students enrolled in these elective courses: Stress Prevention and Management, Yoga 1/week, or Yoga 2/week would be able to reduce their stress (measured by PSS-14) over a course of one semester. Students in the SRT class practiced a variety of breathing, relaxation, and coping techniques such as: mindful breathing, qi gong, meditation lead by the instructor for 15 min/period. Students were encouraged to practice outside of class time. The instructor taught Kripalu yoga, in the Yoga1/week or Yoga2/week for 30 min. This a form of Hatha yoga emphasizing self-compassion and self-awareness. Students took a Perceived Stress Scale (PSS-14) survey consisting of 28 questions on the first and last day of class. Overall, anxiety as measured by the PSS-14, decreased in students regardless of the class taken. The reduction in anxiety scores were not due to any independent variables: gender; course; grade level; if subjects have children; subject’s employment status; evidence of previous experience with relaxation techniques; frequency of practice of relaxation techniques; frequency of exercise had no influence on the amount of change in anxiety scores. These findings suggest that undergraduate and graduate students can reduce anxiety levels by learning and adopting general SRT.

Mentor: Rafael Bahamonde, School of Physical Education and Tourism Management, Department of Kinesiology at Indiana University Purdue University Indianapolis

42. Low Magnitude Mechanical Signals Suppress Expression of Osteolytic Genes in C4-2B Human Prostate Cancer Cells

**Jovana Dodevska**, Xin Yi2, Laura E. Wright3, Gabriel M. Pagnotti3, Khalid S. Mohammad3, Theresa Guise3, William R. Thompson2
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Androgen deprivation therapy (ADT) improves disease-free survival of patients with androgen-responsive prostate cancer, but the associated musculoskeletal effects result in increased muscle weakness, bone fracture and death. The growth factor rich bone microenvironment supports cancer growth and invasion, while states of high bone turnover perpetuate metastatic potential and bone lysis. Low magnitude mechanical signals, delivered in the form of low-intensity vibration (LIV), stimulate bone formation. Preliminary data show that direct application of LIV to breast cancer cells suppresses invasion and secretion of factors that promote osteolastogenesis. This study examined the direct effects of LIV on human prostate cancer cells, hypothesizing that LIV suppresses catabolic gene expression, which exacerbates bone lysis. Human C4-2B prostate cancer cells were exposed to LIV (90Hz, 0.3g) in twenty-minute bouts, twice a day. LIV treatment resulted in decreased expression of PTHrP, CTGF, IL-11, and RANKL mRNA. While preliminary, this data suggests that direct application of LIV to human prostate cancer cells suppresses expression of genes that promote osteolysis. Work is ongoing to determine the mechanisms by which LIV influences the metastatic phenotype of prostate cancer cells. Prostate cancer patients may benefit from a desperate need of a novel treatment that restricts the osteolytic nature of the cancer cells without the adverse effects of ADT, and this data reveals the auspicious role of LIV in its design.

Mentor: William R. Thompson School of Health and Rehabilitation Sciences, Indiana University, Indianapolis, IN 46202
Transcranial direct current stimulation (tDCS) is a non-invasive brain stimulation technique that has been applied to the primary motor cortex (M1) to facilitate learning of skilled, dexterous hand tasks. Recent studies have even used it to shorten training periods for learning precise neurological skills with small instruments. However, it is unknown if the acquisition of the motor skill is due to consolidation, or learning over many days, or if skill proficiency can be observed in as little as a single practice session. The purpose of this study was to examine performance of a fine-motor skill tweezer task with the non-dominant hand while the subject received either anodal (facilitate learning), cathodal (inhibit learning), or sham stimulation conditions. 53 healthy young adults (age: 22.8 ± 3.3) were randomized into either anodal (n=16), cathodal (n=19), or sham (n=18) stimulation groups. The Edinburgh Handedness Inventory was used to determine their hand-dominance. Subjects completed a pre-test of the O'Connor Tweezer Dexterity Test followed by 20 minutes of practice with concurrent tDCS (based on their randomized condition) and then a post-test. The task consisted of using tweezers to place small metal pins into individual holes on a test board with the non-dominant hand. Pre-and Post-test performance was assessed by the time it took to place 50 pins. For practice, subjects filled one row of pins at a time followed by 30 seconds of rest after each completed row. tDCS electrodes were placed over the M1 cortical area for the non-dominant hand and the contralateral supraorbital area. A current strength of 1mA was applied for 20 minutes in the anodal and cathodal conditions. Sham stimulation was applied according to established blinding procedures with a brief ramp in current followed by the current ramping back down. Practice performance was assessed by dividing the total practice into quartiles and assessing the average time per row for each quartile. All data were logarithmically transformed for parametric testing of the geometric means. There was a significant main effect of time (p<0.001) as allstimulation groups increased their speed to place 50 pins from pre-to post-test (p<0.001 to p=0.025). During practice, the average time spent placing each pin increased significantly from the first 25% to the last 25% of practice in the cathodal condition (p<0.001). Performance remained consistent across practice for Anodal and Sham conditions. The results indicate that anodal stimulation did not facilitate learning in the tweezer task, but cathodal stimulation can slow the acquisition of the skill at least in a single-session of practice.

Norepinephrine, like dopamine and epinephrine, is a catecholamine neurotransmitter. Norepinephrine is naturally produced in the body and plays an integral part in the sympathetic nervous system as a stress hormone that controls our flight-or-fight response. It has been used clinically to treat heart failure and low blood pressure. In order to view norepinephrine's interaction with lipid vesicles we used 1H NMR measurements to detect chemical shift changes as a function of hydrophobicity. Calibration of the hydrophobicity scale was accomplished by measuring norepinephrine aromatic ring chemical shift changes at varying percentages of isopropanol in D2O. This calibration was then used to determine the extent of norepinephrine hydrophobic interaction with DOPC and DOPS lipid vesicles. Differences in the extent of hydrophobic change in chemical shifts for the different hydrogens on the ring would indicate norepinephrine's preferential orientation when bound in the membrane.

Trisomy of human chromosome 21 (Hsa21), also known as Down syndrome (DS), is the most common cause of genetic intellectual impairment. Due to advances in modern medicine, individuals with Down syndrome are living longer, and there is a need to find a suitable treatment to improve their cognitive function. The DS community has an interest in nutritional supplements, such as Epigallocatechin-3-gallate (EGCG), or green tea extract, due to two clinical trials in Spain reporting minimal improvement after treatment with green tea extract. Anecdotal evidence suggests that caregivers of individuals with DS are giving their children EGCG or green tea extract. This may be problematic because EGCG has been shown to adversely impact bone strength in mice, and the effects of high doses of EGCG or green tea extract in individuals with DS have never been studied. Our lab has used >95% EGCG in DS mouse models at multiple doses without any cognitive improvement. To ascertain how widespread the use of EGCG or green tea supplements are in individuals with DS, we have disseminated a nationwide survey containing a number of questions regarding the use of EGCG or green tea extracts, such as dosage, length of administration, type of green tea extract, and effects of administration. We hypothesize that quantifying EGCG or green tea usage in individuals with DS will give valuable insight into the DS community's perception, knowledge, and usage of EGCG as a nutritional supplement with potential therapeutic effects.
Infants hospitalized in neonatal intensive care units (NICUs) are at high risk of developmental delay in early childhood. The Indiana University Newborn Follow-Up Program (NBFU) provides development screening at standardized intervals and offers one formal developmental assessment to NICU graduates from three Indianapolis hospitals. Of 828 program participants reviewed, only 245 agreed to complete the formal assessment at 2 years of age. The purpose of this project was to determine what factors are associated with participation in the formal assessment. A retrospective chart review was performed for participants in the NBFU between 2012-2015. The participants were divided into two groups: formal assessment completed and no formal assessment completed. Demographics, developmental risk level and prior program participation were compared between the two groups. As a proxy for severity of diagnosis, length of NICU stay (LOS) predicted nonparticipation in the formal developmental assessment. Prior program participation was associated with formal assessment completion when groups were compared as no participation versus any participation as well as low participation versus high participation. Neither race nor sex were predictive of assessment completion. Completion of a formal developmental assessment was associated with prior program compliance and diagnostic severity as indicated by LOS. To increase participation in formal assessment, efforts should be focused on children with low diagnostic severity and families that do not consistently participate in standardized screening.

Mentor: Heidi Harmon, Department of Pediatrics, IU School of Medicine; Abbey Hines, Department of Pediatrics, IU School of Medicine

47. Genetic Variation of Anti-aging Gene FGF23 is Associated with Larger Cortical Thickness in Alzheimer's Disease

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Introduction: Age is the most important risk factor for Alzheimer disease (AD). The aging brain undergoes structural atrophy predominantly in the medial temporal lobe. Recent study suggests an anti-aging gene, fibroblast growth factor 23 (FGF23). Objective: To investigate whether genetic variation in anti-aging gene FGF23 provides resilience against brain atrophy and AD pathology. Methods: 1,565 non-Hispanic Caucasian participants from the Alzheimer's Disease Neuroimaging Initiative (ADNI) cohort with both neuroimaging MRI scans and genotype data were included in this analysis. Statistical analysis was performed for SNPs (single nucleotide polymorphisms) in FGF23 with age, sex, education, intracranial volume, and magnetic field strength as covariates. The correction for multiple comparisons was performed using permutation and random field theory at a 0.05 level of significance. Results: One SNP (rs10744645) within a region of ±20kb from FGF23 were significantly associated with entorhinal cortical thickness (corrected p<0.05). Whole-brain imaging analysis showed that rs10744645 was significantly associated with cortical thickness especially in the temporal, parietal, and frontal lobes (corrected p<0.05). Further analysis revealed that rs10744645 was significantly associated with memory performance (p=0.041) and a global cortical measure of brain amyloid-β (Aβ) burden (measured by [18F] Florbetapir PET) (p=0.027). In addition, cis-eQTL mapping analysis revealed that rs10744645 is associated with FGF23 gene expression in the temporal cortex in healthy individuals (p=0.013). Conclusions: This study shows that genetic variation in anti-aging gene FGF23 may be associated with smaller brain atrophy and better memory performance and may promotes a resilient brain in AD.

Mentor: Kwangsik Nho, Center for Neuroimaging, Department of Radiology and Imaging Sciences, Center for Computational Biology and Bioinformatics, Indiana University School of Medicine
48. Developmental and Sex-Specific Differences in Trisomic Dyrk1a Expression in Brain Regions of Ts65Dn Down Syndrome Mice
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Down syndrome (DS) is caused by the triplication of chromosome 21 (Hsa21) in humans and is the leading genetic cause of intellectual disability. Ts65Dn mice are used as a model of DS and are trisomic for ~50% of homologous genes on Hsa21. Mouse models of DS show sex-specific differences in anxiety and composition of some brain structures. Despite observed differences between sexes, limited research has been done to determine if differences in protein expression of trisomic genes exist, and none has examined whether trisomic protein expression varies by sex or development. Overexpression of Dyrk1a, a gene triplicated in both individuals with DS and Ts65Dn mice, has been linked to DS cognitive phenotypes. For this reason, Dyrk1a has been touted as a target for drug development. We hypothesized that trisomic males and females differentially express Dyrk1a protein during critical periods of neurodevelopmental development. This study quantified Dyrk1a protein in the hippocampus, cerebellum, and cerebral cortex at postnatal days 6-18 in male and female Ts65Dn mice. Preliminary results indicate that male and female have different patterns of Dyrk1a dysregulation, but also share some commonalities in time and brain region of Dyrk1a overexpression. This study provides crucial information as to whether there may be important differences between males and females that need to be considered in devising therapies targeting DYRK1A for individuals with DS.

Mentor: Dr. Charles Goodlett, Dr. Randall Roper

49. Combined Alcohol and Methamphetamine Abuse: A Link to Parkinson's Disease?
Zoe Talman, Amanda Blakerb,c, Bryan Yamamoto
a. IUPUI Post-Baccalaureate Research Education Program, Indiana University School of Medicine, Pharmacology and Toxicology Department. University of Toledo, College of Medicine, Department of Neurosciences

People who use methamphetamine are three times more likely to be diagnosed with Parkinson's disease (PD) later in life and often suffer from comorbid alcohol use disorder. The combined effects of both alcohol and methamphetamine on alpha-synuclein, the protein associated with PD, is still unknown. Thus this study was conducted using a clinically relevant chronic alcohol abuse and binge methamphetamine model, to examine if combined alcohol and methamphetamine abuse created an enhanced neurodegenerative effect on dopaminergic neurons in the substantia nigra pars compacta and striatum via increased expression of alpha-synuclein, reminiscent of PD. This study also investigated the effect of combined drug abuse on Braak staging of PD, in which neurodegeneration and alpha-synuclein overexpression occur in the gut before migrating to the brain via the vagus nerve. Using western blotting and immunofluorescence, alpha-synuclein protein was examined in the colon of comorbid alcohol and meth-exposed rats compared to meth-alone rats. Co-labelling of tyrosine hydroxylase and alpha-synuclein was observed in the substantia nigra. Taken together, this preliminary data suggests that comorbid drug use may be involved in informative aspects of Parkinson's Disease. A greater understanding of these interactions between drugs of abuse and subsequent neurodegeneration may lead to new pharmaceutical targets, allowing us to mitigate the long-term effects of addiction in an aging population.

Mentor: Bryan Yamamoto
50. Trigger Point Self-Care for Chronic Neck Pain: Pilot Study Results

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Massage is promising for chronic neck pain (CNP) but accessibility is limited due to out-of-pocket costs. Trigger points contribute to CNP and trigger point self-care (TrPtSc) may be an effective way for massage benefit to reach broad populations. This proof-of-concept/feasibility study sought to examine trigger point self-treatment effect for CNP. Non-obese adults with self-reported, nonspecific and uncomplicated CNP were recruited for a three-armed, randomized pre/post trial with 1, 4, and 8 weeks follow-up: 1) training workshop and TrPtSc, 2) four weekly 1-hour individualized practitioner provided massages, or 3) no treatment/control. Three visual analogue scales (VAS) for current, average, and worst neck pain over the past week and three 11-point pain scales for current, best, and worst CNP assessed pain intensity. Forty-six (n=36 females) adults, aged 19-67 (mean=47.6±12.9) enrolled. Five enrollees (n=1 female) were excluded from analysis due to missing data and early withdrawal resulting in N=41. Within group analysis indicated improved current and worst pain VAS scores for TrPtSc (p=0.003;0.007, respectively) and massage (p=0.02;0.05, respectively) groups and improved average VAS (p=0.009), current 11-point pain (p=0.02), and best 11-point pain (p=0.018) for the TrPtSc group. TrPtSc improved current 11-point (p=0.029) and VAS pain (p=0.044), worse VAS pain (p=0.049), and best 11-point pain (p=0.004) compared to control at week 8. TrPtSc and massage were both effective for CNP after four weeks but only TrPtSc retained benefit and continued to improve at week 8. Fully powered, larger research is needed to confirm trends and determine the extent to which TrPtSc alone or combined with massage contribute to CNP's long-term management.

Mentor: Dr. Niki Munk, Indiana University School of Health and Rehabilitation Sciences, Indianapolis, IN, United States

51. The effects of peer led teaching on pre and post-examination scores and openness to food nutritional exploration.

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This project was created to allow students to investigate eating habits from other cultures to search for better options to improve lifestyle wellness and offer health enhancing benefits—thus the project name: Indiana Jones and the Temple of Food. The purpose of this study was to analyze and interpret data collected over the course from spring of 2013 to fall of 2017. An assessment was taken by each student in the course ~5 weeks into semester; questions consisted of six knowledge based multiple-choice questions that covered global nutrition and eating patterns, followed by three opinionated questions concerned with the students’ openness to explore new diets outside of their culture. This same assessment was given again ~5 weeks later. In between assessments, students completed the Indiana Jones and the Temple of Food project. Pre and post test score (out of 6) were inputted into SPSS. A dependent t-test compared the pre and post test scores, while the opinion scores will be analyzed a future time. Results showed that the change in scores was significant at a p<.01 level. Pre-test scores significantly increased from 4.04±1.21 to 4.93±1.03 at posttest. In conclusion the project intervention provided a significant increase in students' knowledge about specific eating patterns. This project opens the door to learning about new and healthy alternative eating habits not common in Western diet. Food brings us together and not only provides nourishment, but also develops our lifestyle wellness.

Mentor: Dr. Niki Munk, Indiana University School of Health and Rehabilitation Sciences, Indianapolis, IN, United States
52. Preclinical Treatment of Neurobehavioral and Brain Structural Deficits in the Ts65Dn Down Syndrome Mouse Model with a Novel Dyrk1a Inhibitor

Jake A. Whiteside, Megan Stringer, Randall J. Roper, & Charles R. Goodlett IUPUI, Department of Psychology, 402 North Blackford Street, LD 124, Indianapolis, IN 46202-3275 IUPUI, Department of Biology, 723 West Michigan Street, SL 306, Indianapolis, IN 46202-3275

Down syndrome (DS) is a disorder caused by triplication of human chromosome 21 (Hsa21), and is characterized by multiple cognitive deficits and structural deficiencies in the hippocampus, cerebral cortex, and cerebellum. One of the genes triplicated in individuals with DS, Dual-specificity tyrosine phosphorylation-regulated kinase 1a (Dyrk1a), is overexpressed at certain developmental timepoints, and has been linked to learning and memory deficits in DS. The Ts65Dn mouse model of DS carries three copies of approximately half of the genes triplicated in human DS including Dyrk1a and exhibits many of the behavioral, cognitive, hippocampal cell proliferative, and craniofacial abnormalities seen in humans with DS. Inhibition of Dyrk1a has been proposed as a means to improve DS cognitive deficits, and Dyrk1a inhibitors are currently in clinical trials as anticancer agents. This study tested the hypothesis that treatment with a novel Dyrk1a inhibitor in the DS mouse model will improve behavioral development and rescue hippocampal neurogenesis in preweaning Ts65Dn mice compared to euploid littermates. This study utilized open field activity and a homing task to assess behavioral consequences of the treatment. Bromodeoxyuridine (BrdU) was then injected, brains harvested two hours later, and immunohistochemistry of BrdU-labeled cells was used to quantify proliferation of neuroprogenitor cells (NPC) in the subgranular zone of the hippocampal dentate gyrus. Preliminary results indicate that the Ts65Dn control mice have reduced rates of NPC proliferation and that postnatal treatment with this novel Dyrk1a inhibitor does not fully rescue either the behavioral or the cell proliferation deficits in Ts65Dn mice to levels of euploid controls. Further research is needed to provide evidence that targeting trisomic Dyrk1a with inhibitors during age-specific periods of overexpression will correct cognitive and structural deficiencies.

Mentors: Charles R. Goodlett, Department of Psychology, School of Science, IUPUI; Randall J. Roper, Department of Biology, School of Science, IUPUI

53. Investigating Climate and Society Linkages in the Midcontinental United States using High-Resolution Lake Sediment Archives

Briana Ogiego, Grace Bocko
Earth Science Department, IUPUI school of Science

Investigations of climate-society linkages in the Midcontinental US have been limited by a paucity of detailed regional paleoclimate records. Here, we use high-resolution sediment archives from Loon Lake, MN, and Clear Lake, IA, to fill the void in paleoclimate records in the Midwest and test hypotheses surrounding the influence of hydroclimate variability on the rise and fall of Mississippian populations in the Ohio River Valley between 1000 and 1450 CE. Sediment samples from both lakes were subjected to X-ray fluorescence, grainsize, and carbonate isotope analysis with the intention of determining climate patterns in the region over the past 2,000 years. Sediment cores were sampled by centimeter, with each drive being around 100 cm in length and representative of roughly 20 yrs/cm. X-ray fluorescence analysis was used to determine changes in geochemical composition of sediment that are sensitive to watershed processes and anthropogenic pollution. Grain size was analyzed to determine changes in lake level, erosion, and deposition environments. Changes in the ratio of carbonate O16 to O18 were measured on a subset of sediment samples in order to investigate changes in the isotopic composition of precipitation related to atmospheric circulation (Loon Lake) and evaporation (Clear Lake). Mineral content was analyzed through loss of ignition tests. This data provides a basis for the climatological factors influencing Mississippian behaviors observed through the archaeological record.

Mentors: Broxton Bird, Earth Science Department, IUPUI
54. PASSIVE PT-SYMMETRIC ELECTRONICS WITH MEMRISTORS

Zachary A. Cochran
Department of Physics, IUPUI School of Science

PT-Symmetric Electronics has been studied for several years in areas ranging from the basic system to dynamic gain/loss, as well as the passive/lossy system. In this research the passive system has been modified to replace the constant lossy element with a nonlinear loss element called a "Memristor," or a resistor whose value depends on the history of the voltage across it, in order to determine how the linear and nonlinear systems differ in operational point and energy loss. This nonlinear loss element provides the potential to act, to a degree, as a self-regulated resistance, automatically adjusting to attempt to compensate for large or small decay in the system. In this research I describe the behavior of the memristive system when compared to the standard passive system and show through theoretical analysis and simulation that, due to the nonlinear nature of the loss element, the system's region of operation — either the exact region in which there is only one decay rate or the broken region where the decay splits into two elements — can be "shifted" based on the nonlinearity of the system, demonstrating a slower rate of energy loss. Finally, through both simulation and experiment, explore the behavior of the standard passive system and show that the memristor emulator circuit developed by Dr. Leon Chua functions as a suitable memristor emulator for exponentially realizing the theoretical system.

Mentor: Dr. Yogesh Joglekar, Department of Physics, IUPUI School of Science

55. An efficient synthesis of acetylenic natural product through a biorenewable precursor

George B Walbridge, Robert Minto
Chemistry, School of Science

Natural products have played an outstanding role in chemistry for many years by supplying fine chemical precursors for a multitude of syntheses. We are exploring methyl oleate as the starting reagent for many polyunsaturated and acetylenic lipid natural products due to it being readily available and quite inexpensive. The pathway shown below holds promise as a possible route to synthesize an unnatural acetylenic lipid. Hoyveda-Grubbs 2nd generation catalyst has been reported to be effective with allyl chloride and allyl alcohol as the substrates and efficient at 0.1% catalyst loading. Given the preponderance of cis alkenes in lipid-derived natural products, the effectiveness of an ewer Z-Selective Ruthenium catalyst was examined. Prior to using the Z-selective catalyst, tests to ensure that published protocols can be reproduced and to determine limitations for this chemistry were taken. Multiple isomers were among the products that formed, showing that the stereochemical control for the Z-selective catalyst will be critical.

Mentor: Robert Minto

56. Investigating Climate and Society Linkages in the Mid-Continental United States using High Resolution Lake Sediment Archives

Olivia J. Burl1, Elisabeth M. Huls2, Izabelle K. Manning3,
1Department of Computer Information and Graphics Technology, Purdue School of Engineering and Technology 2Department of Biology, Purdue School of Science. 3Department of Psychology, Purdue School of Science.

The purpose of this research project is to investigate climate and societal linkages in the mid-continental United States using high resolution lake sediment archives from Cottonwood Lake, MN and Storm Lake, IA. The Mississippian Native American civilization collapsed right before the discovery of the Americas by Columbus. There is evidence to suggest that a change in climate caused crops to fail and food shortages became the origin of warfare. Climate mapping helped indicate the fall of the society. The climate reconstruction was collected using the following approach: X-ray fluorescence (XRF) analysis and carbonate analysis. The data obtained from the XRF indicated percentages of certain elements throughout the extracted sediment core which expressed periods of wet and dry climates over time. The carbonate data indicated the oxygen isotope compositions of the lakes to express the periods of evaporation and precipitation, with the lighter oxygen isotope (O-16), rather than the heavier one (O-18), being more present during times of precipitation than evaporation. This data served as a signal for how wet or dry the climate was at the time and the precipitation patterns of the region. The results gathered from the analysis of the lake data offered a better insight on the fall of the Mississippian civilization as well as climate trends in the mid-continental United States.

Broxton Bird, Department of Earth Sciences, Purdue School of Science, IUPUI; Jeremy Wilson, Department of Anthropology, IU School of Liberal Arts, IUPUI; William Gilhooly, Department of Earth Sciences, Purdue School of Science, IUPUI
Filth flies have long been implicated in pathogen transmission routes in which it is thought that they acquire pathogens directly from infected feces and mechanically transmit them to humans and animals. Currently, however, no analytical method for identifying feces as the source of fly-related pathogens exists for applied settings. A qualitative method to detect various tetrapyrrole urobilinoid-sensitized with vertebrate feces was created in order to definitively link flies to fecal resources. Flies from three feeding treatments (unfed flies, liver fed flies, and feces fed flies; N = 20 flies/treatment) were analyzed using a Thermo LTQ-XL mass spectrometer (San Jose, CA) coupled to an Agilent 1100 HPLC. The sample was separated using reversed phase chromatography on a 100 x 2.1 mm C18 column at a flow rate of 200 uL/min. The solvents were 0.1% formic acid in water (solvent A) and 0.1% formic acid in 70:30 acetonitrile:methanol (solvent B). The separation began with an initial 1 minute hold at 30% B followed by a 9 minute linear gradient from 30 to 95% B. Data were acquired in positive ion mode. Two peaks indicating the presence of the compound class of interest were present at a retention time of ~6.5 minutes containing the m/z 343 and ~8.2 minutes containing the m/z 466. Confirmatory tests were run on fly extracts where different types of animal feces were consumed to verify that the urobilinoid compounds would be present regardless of dietary restrictions.

Mentor: Christine Picard, PhD1,3 and Nicholas E. Manicke, PhD1,2

58. Improving Interventions Designed for Pediatric Patients Diagnosed with ADHD and Anxiety

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1Department of Biology, IUPUI; 2Department of Pediatrics, IU School of Medicine; 3Department of Communication, IUPUI

One approach to decreasing the number of clinical trials that fail due to recruitment issues is to engage stakeholders in the earliest stage of the study using qualitative methods. Qualitative approaches allow researchers to learn what is important to representative stakeholders so interventions can be designed to meet their needs. Data from these approaches were planned for integration into the redesign of two interventions to improve adoption and uptake in future clinics and with more families. TEACH (Tailoring Education for ADHD and Children’s Health) is a group visit model for ADHD care, and CHICA (Child Health Improvement through Computer Automation) has a module to help providers identify anxiety as early as possible during visits to the clinic. Qualitative interviews were conducted with stakeholders and providers and caregivers of children with ADHD (n=10) and anxiety (n=30) to understand implementation facilitators and challenges so improvements can be made prior to implementation elsewhere with new clinics and families. Responses were coded guided by the Consolidated Framework of Implementation Research (CFIR) and coded within NVivo. Valuable feedback was obtained through this methodology and refinements to each of the interventions will be incorporated. Findings from these two projects will be used in peer-reviewed papers.

Mentor: Nerissa S. Bauer, Department of Pediatrics, IU School of Medicine

59. Physical and sexual abuse as risk factors for violent crime: Important points of intervention to reduce recidivism

Taylor Hunton, Alexandra R. Hershberger, Matthew A. Aalsma, Melissa A. Cyders; IUPUI

Introduction. Violent crimes committed by youth have a negative impact on both the youth committing the crime, including increasing risk for recidivism and poor functioning into adulthood, and society as a whole. Although often conceptualized as having disruptive behavioral problems, juvenile justice involved youth face a traumatic history of physical and sexual abuse and it is possible that these factors may increase risk for committing violent crimes. Intervening prior to or following this abuse could mitigate violent crime risk. The present study aimed to examine the relationship between sexual and physical abuse and violent crimes committed by juvenile justice involved youth. Methods. Data were collected from court-ordered assessment reports of 303 juvenile justice involved youth (mean age = 15.36 years, SD = 1.453; 23.8% White; 22.8% girls) in Indianapolis, Indiana. Youth self-reported their history of physical and sexual abuse and court-records provided their history of violent crime. Results. One hierarchical linear regression was used to examine the relationship between both sexual and physical abuse and the number of violent crimes committed, controlling for age, race, and gender. Results indicated that the overall model was significant (adjusted R² = 0.03; p = .03). The relationship between violent crimes committed and both sexual abuse (b = 0.33, p = .08, 95% CI: 0.04 to 0.70) and physical abuse (b = 0.32, p = .06, 95% CI: 0.01 to 0.64), although falling just short of statistical significance, produced small effect sizes (r = 0.11 and r = 0.10, respectively). Discussion. Together, sexual and physical abuse are related to the number of violent crimes committed by juvenile justice involved youth. Prevention and intervention strategies aimed at physical and sexual abuse in this population could be prime interventions with positive impact, potentially reducing violent crime and associated negative outcomes. This should be examined in future intervention research.
Popular culture and medical lore have long postulated a connection between full moon and exacerbations of psychiatric disorders. We wanted to empirically analyze the hypothesis that suicides are increased during the full moon. We analyzed data from the Marion County Coroner’s Office spanning a five year period (2012-2016), and show that suicides are significantly increased during the full moon (p=0.03). As a control, homicides and motor vehicle accidents were not increased. We discuss possible mechanisms having to do with circadian rhythms and their influence on mood and suicidality.

Mentor: Alexander B. Niculescu, MD, PhD IU School of Medicine; George Sandusky, PhD IU School of Medicine

Indiana adolescents spend over one-thousand (1,000) hours annually in the classroom, which accounts for almost an half an entire calendar year. These numbers highlight how school exhausts adolescents’ time and therefore, is not just a setting for academic learning, but also the accumulation of social attitudes and skills. Specifically, this researcher was interested in how school connectedness directly affects academic success and emotion regulation and through which, indirectly influences relationship quality with a romantic partner and condom use self-efficacy. Data for this study were drawn from the Young Men's Project (YMP), a longitudinal cohort study of sexual relationships and sexual behavior in middle to late adolescent men. Participants (N=75; 60% African American) were recruited from low to middle income communities associated with early intended pregnancy and STI. Structural equation modeling (SEM) was the statistical analysis technique utilized and preliminary results show that the structural relationship between school connectedness, academic success and emotion regulation, romantic relationship quality, and condom use self-efficacy appears to be significant. Chi-square (19.277), CFI (0.970), and RMSEA (0.027) all support the researcher's hypothesis that these variables are associated. The probability levels for the most significant paths in the model are: school connectedness on academic success (p=0.022), school connectedness on emotion regulation (p<0.001), and relationship quality on condom use self-efficacy (p<0.001).

Mentor and Advisor: Devon J. Hensel, Department of Sociology, IU School of Liberal Arts, IUPUI

Social disorganization theory suggests that neighborhoods with fewer resources – including lower social connection between neighbors, lack of social control to both deter the behaviors that negatively impact health, as well as to promote the behaviors that bolster health. However, most of the current literature measure health outcomes using retrospective and/or using one-time measurement, making it difficult to understand how neighborhood context impacts day-to-day behaviors in young men. For this project, we examine how neighborhood characteristics act as predictors for pro-social and anti-social behaviors. Data were collected as part of a larger longitudinal cohort study - The Young Men’s Project (YMP:2009-2012) – examining sexual relationships, sexual behaviors and STIs among adolescent men in middle to late adolescents. We used four measures of neighborhood context drawn from enrollment data and analyzed their relationship to pro-social and anti-social daily behaviors (e.g. Hang out with family, skipped school). We found that increased neighborhood connectedness and resources are associated with higher odds of various pro-social behaviors and fewer specific anti-social behaviors (e.g. substance use). Neighborhood fear and problems were associated with increased odds of various anti-social (deviant) behaviors. Positive (e.g. neighborhood connectedness and neighborhood resources) and negative (e.g. neighborhood fear and neighborhood problems) traits impact young men’s day-to-day activities in complex ways, promoting both pro- and anti-social behavior. Ongoing research should continue to examine the ways in which young men adjust and adapt behavior within their perception of the environment in which they live.

Mentor: Devon J. Hensel (Department of Sociology, IU School of Liberal Arts, IUPUI)
63. The relationship between family history of alcohol use and problematic alcohol use in electronic cigarette users: The mechanistic role of positive alcohol expectancies
Amanda L. Studebaker, Alexandra R. HershbergerMS, Melissa A. CydersPhD
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Introduction: Family history of alcohol use (FHA) serves as an important risk indicator for problematic alcohol use. No research to date has examined if FHA also serves as a risk indicator for problematic alcohol use in electronic cigarette (e-cig) users, and more specifically, the potential mechanisms which could partially explain this relationship. The present study examined positive expectancies of alcohol use (e.g. alcohol use makes me feel happy) as a potential mechanism in the relationship between FHA and problematic alcohol use.

Method: A total of N=25 community dwelling e-cig users (mean age=27.60, SD=14.74, 64% male, 52% White, 28% Black) provided data in the laboratory on their FHA (number of first degree relatives with alcohol related problems), positive alcohol expectancies (Alcohol Expectancy Questionnaire), and problematic alcohol use (Alcohol Use Disorder Identification Test). Results: We conducted a mediation using Andrew Hayes PROCESS macro for SPSS with FHA entered as the independent variable, problematic alcohol use and the outcome variable, and positive alcohol expectancies as the mediator. Results indicated that the relationship between FHA and problematic alcohol use was significantly mediated by positive expectancies of alcohol use (b=1.48, SE=0.84, 95% CI 0.32 to 3.74).

Discussion: The present study highlights that e-cig users with a family history of alcoholism report higher levels of problematic alcohol use, which is in part explained by higher positive expectancies of alcohol use. Thus, positive alcohol expectancies could be an important intervention target in e-cig users with a family history of alcoholism in order to decrease problematic alcohol use.

Research Mentor: Dr. Melissa Cyders PhD

64. Intrinsic vs Extrinsic Motives for Volunteering: Impact on Corporate Social Responsibility
Jabari Artis, Brandon Sorge, Katrenia Reed Hughes

The 2016 Lilly Global Day of Service (LGDOS) program in Indianapolis was created as a corporate social responsibility program by Eli Lilly & Company (Lilly), an international Fortune 500 corporation. Employees at Lilly spent a day completing community service activities. Eli Lilly actively pursues community involvement and corporate social responsibility (CSR) with a vision of strengthening communities and improving lives. Approximately 1,000 Lilly volunteers who participated in the 2016 Lilly Global Day of Service, participated in this study. Data collected beyond motivation and impact questions included items such as the theme and type of project completed, participant's age, years in the workforce, years at Lilly, job area and classification, educational attainment, and previous volunteer experience. Participants were classified as general volunteers, area coordinators, and/or team captains, and were assessed depending on their classification. The LGDOS participant survey was developed in cooperation between the Lilly LGDOS leadership team and a team of graduate students and faculty from the Department of Technology Leadership and Communication in the Purdue School of Engineering and Technology at IUPUI. The LGDOS survey predominantly used 5-point Likert scale questions. This research explores the relationship between employee's demographic information and their intrinsic and extrinsic motivation behind volunteering in CSR efforts. The presence of this relationship will present a number of implications for CSR practices. Implications which can impact all businesses and organizations. Significant differences in intrinsic motivation levels were found in years of demographic categories such as employment, age, and gender.

Brandon Sorge (Mentor) and Katrenia Reed Hughes (Advisor)

65. LiFT Me-Lift Me-A Motivational Application to Support Underrepresented Students in STEM
Amanda Echegaray, Mathew Palakal, and Molly Morin
Department of Informatics, IU School of Informatics and Computing at IUPUI

Recent research shows that underrepresented students in STEM and students from low-income backgrounds are more inclined to experience a decreased sense of belongingness in the college environment thus affecting their academic performance and participation of their 1st year. Studies have also included that when students have positive mentoring experience, receiving interactions of invitation or inclusion, they are more apt to persist in college. In this study, our purpose is to combine methods of mentoring and user-friendly avatars to support the student success of underrepresented minority (URM), low-income, and first-generation students in Informatics who are participants in the LiFT Scholars Program. Data from student academic and co-curricular performance, interviews and surveys will be utilized to develop a virtual motivational mentoring support. This research will enhance the success of underrepresented students in STEM by the additional support of virtual motivational mentoring.

Mentor: Mathew Palakal, Department of Informatics, IU School of Informatics and Computing