College of Science

COS

Undergraduate Research

URC

Colloquium

2017

Thursday, April 27, 2017

Lobby and Grand Tier II
Center for the Arts

GEORGE MASON UNIVERSITY

Welcome

to the 7th Annual
COS Undergraduate Research Colloquium!

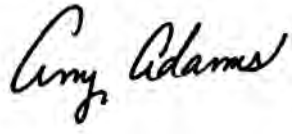
The College of Science (COS) at George Mason University is committed to excellence in undergraduate research. According to the Council on Undergraduate Research (CUR), "undergraduate research is an inquiry or investigation conducted by an undergraduate student that makes an original intellectual or creative contribution to the discipline". Students from across COS use new knowledge acquired through undergraduate research to produce novel results that have made a difference in their disciplines. To make their research experience more meaningful, students must also learn to promote and communicate their findings to a broader community of learners. This is the mission of the COS Undergraduate Research Colloquium. Whether you participate in this event as a presenting undergraduate student, mentoring faculty, judge or guest, we are confident there will be a tremendous exchange of new knowledge.

The College of Science thanks the research mentors who have invested their time to guide and support these undergraduate students. This investment helps student researchers become competent, and it helps to create and sustain an institutional culture in which peers, graduate students, faculty, and administrators continue to learn and evolve with them.

As organizers of this event, we thank you for participating in this annual tradition to support the efforts of undergraduate researchers in COS. These students are change agents who not only help enhance ongoing interaction among communities of people including students, educators, academicians, and the surrounding Mason community, but who also serve as catalysts to reinforce and drive reform across STEM disciplines for all society.

Sincerely,

Rebecca M. Jones, Ph.D.
Term Associate Professor,
Department of Chemistry
STEM Accelerator, College of Science



Amy Adams, M.S.
Scientific Outreach and Education Program Manager , College of Science

Agenda

Lobby, Center for the Arts

1:00pm-3:00pm – Poster Session

3:00pm-3:30pm – Networking Reception

Grand Tier III, Center for the Arts

3:30pm-3:35pm – Ali Andalibi, PhD, Associate Dean for Research, College of Science

3:35pm-3:50pm – Student Keynote Address by Lynn Bonomo, "Pollen Diversity and Disease Susceptibility in Common Eastern US Bumble Bees"

3:50pm-4:05pm – Student Keynote Address by Ryan W. Pfeifle, "In Search of Tiny Giants: Finding Supermassive Black Holes in Low Mass Galaxies"

4:05pm-4:20pm - Peggy Agouris, PhD, Dean, College of Science

4:20pm-4:30pm – Poster Awards

4:30pm - Closing remarks**,** Rebecca Jones, PhD, STEM Accelerator

Poster Category Divisions

Poster Numbers	Category
1-26, 47-48	**Life Science:** Neuroscience, Biology, Forensic Science, Medical Technology, Environmental Science
27-41	**Physical Science:** Math, Physics, Astronomy, Chemistry
42-46	**STEM Education**

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Physical Science

Poster #	Project Title	Authors
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28	*Semi-Synthesis of Novel Non-Immunosuppressant FKBP Inhibitors*	Kaitlyn Power, Dr. Mikell Paige, Young-Ok You
29	*A Global Survey of EUV Solar Corona Power Spectra*	Brendan Gallagher, Karl Battams, Robert Weigel
30	*A noninvasive inductance sensor for the measurement of nanoparticles*	Brittany Rapp, Abul Hussam
31	*Chua's Circuit: Analyzing Power Fluctuations in a non-Equilibrium Chaotic System*	Chris Carlson, John Cressman
32	*Developing Novel Antibiotics Targeting the MEP Isoprene Biosynthetic Pathway*	Claire Johnson, Amanda Haymond, Haley Ball, Cynthia Dowd, Robin Couch
33	*Identification of Anti-HIV Phytochemical from Plant Extract*	Grey Madison, Haley Ball, Taryn Brooks-Faulconer, Yuntao Wu, Robin Couch
34	*Adsorption of emerging contaminants, carbamazepine, onto humic acid and clay: Equilibrium isotherms and effect of the water matrix*	Jasmine Alizadeh-Saei, Sabrina Barkat, Marjan Alaghmand
35	*Generation of recombinant dehydratase domain of FK506 biosynthase as a tool for non-immunosuppressant PPIase inhibitor production*	Joanne Ji Hyun Min, Young-Ok You
36	*A Survey of Entropic Gravity*	Khunsa Amin, John Robert Cressman
37	*Using Literature-Based Discovery in Medicine to Discover Links Between Disconnected Knowledge Domains: Cholera, Breast Cancer, Alzheimer's, and Diabetes*	Nicky Solares, Mariela Jennings, Nahzic Saloman, William McCarty, Akhila Kandimalla
38	*In search of Tiny Giants: Finding Supermassive Black Holes In Low Mass Galaxies*	Ryan W. Pfeifle, Shobita Satyapal, Mario Gliozzi, Nick Abel
39	*Reactions of Nitrogen Atoms with Acetylene in Argon Matrices*	Savanna Castello, Paul Cooper
40	*An Empirical Investigation of the Deep Structure of Human Knowledge: Causal Relationships and the "Language of Thought"*	William McCarty, Nicky Solares, Mariela Jennings, Nahzic Saloman, Akhila Kandimalla, Douglas Wulf, Joseph Marr
41	*Synthesis and Characterization of Core-shell Hydrogel Particles Containing Cibacron Blue F3G-A*	Zachary Torrey, Yaling Zhu, Barney Bishop

STEM Education

Poster #	Project Title	Authors
42	*Investigating Learning Assistant Oral Review Strategies on Student Learning in Biology Courses at George Mason University*	Areeg Abu El Hawa, Dana Ismail, Andy Hoang, Claudette Davis, Mary Nelson, J. Reid Schwebach
43	*Investigating Different Learning Styles in Anatomy and Physiology Classes*	Danielle Zimmet, J. Reid Schwebach, Allison Tomson
44	*Next-Generation Sequencing*	Rownaq Abidalrahim, J. Reid Schwebach, Jasmine Amirzadegan
45	*Assessing STEM Boot Camp Participation and Academic Performance: A Longitudinal Analysis of Two STEM Boot Camp Cohorts (2013 and 2014)*	Sudaba Rahimi, Gabriella Cuevas, Claudette P. Davis
46	*Comparison of Exams for Active Learning Technologies vs. Traditional Lectures*	Andrew Hornstra, Branislav Djordjevic, Maria Dworzecka

Abstracts

1: Detection of Serotonin in the Primitive Nervous System of Anthozoans

Ahmad Haj-Assaad, Yoo Kyum Cho, Patricia J. Napora, Esther C. Peters
George Mason University

Cnidarians are widely recognized as the first organisms in animal evolution to develop a nervous system. While the presence of a neural net and neurotransmitters have been identified for all Cnidarians, the identity and physiological significance of specific neurotransmitters remain unclear. To better understand this primitive nervous system, a method was developed to detect the tiny neurons of the sedentary benthic Anthozoans known as scleractinian corals, using immunohistochemistry (IHC). An avidin-biotin enzyme complex, heat-induced epitope retrieval and alkaline phosphatase staining were used to detect the presence of serotonin in neurons in the mouse (Mus musculus) and the Caribbean corals Acropora palmata and Diploria labyrinthformis. Positive confirmations of serotonin detection were verified by comparison to negative controls for each tissue sample to eliminate the possibility of false positives. Preliminary results indicate the success of the developed IHC method with detection of: serotonin in Purkinje and ependymal cells in Mus musculus and areas of distinct contrast between the positive and negative controls of the Caribbean corals Acropora palmata and Diploria labyrinthformi. Further research is needed to decrease background staining and affinity of the antibody to positive serotonin sites.

2: Analysis of Coyote Activity Around Waste Disposal Site

Alexis Catherine Garretson, Paul Shumaker, Anna Reid
George Mason University

Research has shown that coyotes are moving into niches once occupied by apex predators, like wolves, in the East. Cattle ranchers/farms and captive breeding centers like the Smithsonian Conservation Biological Institute would potentially be at risk from these animals, but it is unclear what the role of environmental factors like open-air manure pits might be in drawing in these predators. In response, while studying at the Smithsonian-Mason School of Conservation (SMSC), research was conducted to determine if coyotes were being drawn to the area as a result of an open-air manure pit used for waste management on-site. This pit contains not only animal waste, but also remaining pelleted feeds and the remains of animal carcasses from whole prey feeds. Because coyotes are opportunistic generalists, the suspicion was that they might be attracted to the manure pit for an easy meal. The study was conducted using three camera traps each placed at two locations: the manure pit and a control site selected for its similarity to the habitat. These cameras detect movement and heat and, when triggered, take photos of the area that can be analyzed for patterns. The cameras were left out for five weeks, and the resulting photos were analyzed to determine the detection frequency of coyotes. These were averaged at each site and compared to determine whether there was a higher frequency of coyote photos at the manure pit versus the control site. The preliminary results showed that there was a higher incidence of camera trapping events of coyotes at the manure pit when compared to the control site. These results suggest the manure pit may be drawing coyotes to the area, and may have implications for future management at SCBI and other hoofstock conservation centers

3: Multicentric Prospective Randomized Study for the Prevalence and Possible Prevention of Failed Back Surgery Syndrome (FBSS)

Arba Cecia, Ridvan Alimehmeti
Ridvan Alimehmeti: University of Medicine, Department of Neuroscience at University Hospital Center "Mother Theresa", Tirana, Albania

More than 30,000 patients suffering for disc herniation are operated in Italy each year. FBSS has been diagnosed in those patients operated for lumbar degenerative disease who fail to improve at the range of 5 " 50%. The heterogeneity of degenerative affections of the vertebral column (disc herniation, stenosis, instability), the uniformly unestablished criteria for FBSS and the different disciplines that takes care of degenerative spine (orthopaedic, neurosurgical, pain center) gives rise to various percentage of FBSS prevalence in literature. We performed a multicentric randomized prospective study of patients operated for merely lumbar disc herniation (LDH) without stenosis or instability. 197 and 47 patients were relucted in two different centers. 10 patients had a visual analogic scale (VAS) =>4 (0-10) at one month. In 4 patients, a surgical reason was diagnosed and they underwent a second operation with positive result (2 patients with residual Lumbar disc herniation (LDH); 1 patient with instability; 1 patient with Cerebral Spinal Fluid (CSF) collection at surgical site). 1 patent opted for another hospital. In the last 5 patients, normal sedimentation rate (SR), C-reactive protein (CRP) and Lumbar MRI with gadolinium were obtained. They were randomized in one of 3 groups: A -physiotherapy; B " carbamazepine (CBZ); C - CBZ and clomipramine. At six months after operation all had improved at VAS < 3. The overall control at 1 year discovered 3% of VAS 3 which was not considered FBSS, but neither it was deemed satisfactory enough. Our study showed that the prevalence of FBSS is less that the inferior values reported in the literature. Best prevention for FBSS is a correct surgical indication. Early treatment of possible FBSS after the first operation for a lumbar disc herniation can prevent from chronic and refractive postoperative low

4: Evaluating the Effectiveness of Behavior Monitoring Applications in the Red Panda

Ashley Fortner, Elizabeth Freeman
George Mason University

The Red Panda (Ailurus fulgens) is endangered and it is estimated that there are less than 10,000 individuals in the wild. They face numerous threats to their survival including habitat loss, poaching for their fur, and animal traps. Ex-situ conservation can help ensure long-term survival, but low reproductive success, poor milk production, and maternal cannibalism prevent a self-sustaining population. To better understand these challenges, the Smithsonian Conservation Biology Institute (SCBI) and Dr. Elizabeth Freeman have placed motion-activated video cameras within nest boxes of female red pandas at the SCBI to monitor maternal behavior. Although this technique is useful, problems such as cameras constantly running and having to score behaviors by hand makes the data time consuming to analyze. Ruby for Good, a non-profit software company, has developed two programs to aid in red panda monitoring; one that will cut out raw video footage not containing red pandas (dead space) and another that will facilitate scoring panda behaviors. This project looked at whether the program used to cut out dead space is as or more effective at monitoring red panda behavior. To test the effectiveness of this program, behaviors were hand scored and dead space was cut from the 2014 and 2015 birthing season raw data to establish a baseline. The raw video footage was then run through the Ruby software to cut out dead space and red panda behaviors were scored on the remaining footage using the current Behaviour Pro application. The Ruby for Good program has shown to be as effective at cutting out dead space as older methods. The success of this software program will allow researchers to more efficiently gather data and disseminate it faster. Timely feedback will contribute to the development of important management strategies that could enhance reproductive success for this endangered species.

5: The Use of Soluble Guanylate Cyclase Inducer Bay 41-2272 to Reverse Activation in Fibroblasts Derived from Idiopathic Pulmonary Fibrosis.

Bilal Aljeburry, L. Rodriguez, Geraldine Grant
George Mason University

The interstitial lung disease, Idiopathic Pulmonary Fibrosis (IPF), is caused by overly activated fibroblasts. In IPF, Fibroblasts secrete abnormal levels of Collagens 1&3 (COL1, COL3). Additionally, they are marked by high levels of Alpha Smooth Muscle Actin (ACTA2) and Fibroblast Activating Protein (FAP). Bay 41-2272 is an inducer of the soluble guanylate cyclase (sGC) that has previously been shown to decrease cellular expression of COL1 and ACTA2 in rat cardiac fibroblasts. Here we investigate the effect of this compound on the fibroblast activation profile on IPF derived lung fibroblasts. Lung fibroblasts derived from patients with IPF (IPF-F, n=4) and normal age matched control (N-F, n=3) were exposed to 10 uM Bay 41-2272 in serum free media (SFM) and 2% fetal bovine serum supplemented growth media. Additionally, these same cells were treated with 10 ng/ml TGF-Beta in SFM and 2% media. Fibroblast activation profiles were assayed by real-time Q-PCR of COL1, COL3, ACTA2, and FAP. Results: In SFM, Bay41-2272 treated IPF-F resulted in decreased expression of ASMA (2.17 fold, p= 0.0261), COL3 (4.1 fold, p = 0.0001) and no significant change in FAP, COL1. Exposure of IPF-F to TGF-B resulted in decreased expression of COL3 (3.47 fold, p=.0001), and no significant change in ASMA, COL1, and FAP. Additionally, exposure of N-F to Bay 41-2272 resulted in decreased expression of COL1 (2.36 fold, p=0.0076), FAP (1.60 fold, p=(0.0276)), and no significant change in ASMA and COL3. Exposure of N-F to TGF-B resulted in decreased expression of COL3 (1.76 fold, p= (0.0099)), and no significant change for COL1, ASMA, and FAP. In 2% media exposure of IPF-F to TGF-Beta resulted in increased expression of COL1 (3.32 fold, p =0.0105) and no significant changes in ACTA2, COL3, and FAP. TGF-Beta treatment of N-F resulted in no other significant changes to these same genes. Exposure of N-F to Bay 41-2272 resulted in a decreased expression of COL3 (2.19 fold, p=0.0228) and no significant changes in ACTA2, COL1, and FAP. Bay 41-2272 treatment of IPF-F resulted in no significant changes to these same genes. We hypothesized a decrease in all markers. In SFM, TGF-Beta resulted in an unexpected decrease in COL3. In 2% media, the results were not consistent. Due to this inconsistency, it is not possible to conclude what the drug effect may be within pulmonary fibroblasts. Therefore, repeat experimentation with a larger sample size.

6: Efficacy of Exercise in Reducing Anxiety in Female Mice

Brandi Adams, Lauren Rosario, Aide Sanchez, Caroline Neeley
George Mason University

Research points towards gender differences in anxiolytic medicine interactions (Korzeniowska-Kubacka, I. 2016). Women experience anxiety at a higher rate than men, and strategies that benefit men may not generalize across genders. We sought to explore the effect of exercise on anxiety in female mice as an analogue for women. Mice (n=16) were randomly housed in two conditions, one with a running wheel, and one without. Data was collected via elevated zero maze assay, on the 27th day. We expected to find a statistical difference in anxiolytic measures for the mice that had been housed with a running wheel. Data did not violate the assumption of equal variances ($p > 0.05$); therefore we conducted an independent samples t-test to analyze the effects of running wheels on anxiety behavior in the EZM. Mice with running wheels spent more time in the open arms of the maze (21.2 +/- 10%), as well as more head dips (22 +/- 5.4), compared to mice without running wheels (15.2 +/- 11.6%) and (15.8 +/- 8.2) respectively; however this difference was not significant, $t(14) = 1.10$, $p = 0.29$. The difference in exploratory behavior was marginally significant, $t(14) = 1.80$, $p = 0.09$. The study found a statistically significant decrease in anxiety as a result of available exercise. Results show exercise is a promising research topic for anxiety treatments oriented towards women.

7: Antimicrobial peptides against Yersinia pseudotuberculosis

Brekhnaa Gull, Akanksha Kaushal, Monique van Hoek
George Mason University

In recent years, as the use of antibiotics have increased, scientists have discovered that bacteria treated with antibiotics are more likely to develop into resistant strains. The release of bacteria resistant to antibiotics can lead to a global epidemic. For this reason, there has been an urgent need for the development of new methods to kill bacteria. Dr. van Hoek's lab studies antimicrobial peptides (AMPs), which may be useful to treat common bacterial infections. AMPs are small, cationic, amphipathic proteins that are part of the innate immune response and are able to kill bacteria. The ultimate goal of this project is to develop peptides capable of killing dangerous biological warfare bacteria such as Yersinia pestis. As a starting point and a model organism, Yersinia pseudotuberculosis was tested using a collection of different antimicrobial peptides. Y. pseudotuberculosis was treated with different concentrations of antimicrobial peptides in two separate antimicrobial activity assays. The selected peptides included peptides derived from human (LL-37), snake (NA-CATH, ATRA1A and ATRA2) and chicken (C1-15, F2W, F2,5,12W). These results show that while the human and chicken peptides didn't work well in the high-salt conditions (under MIC conditions), the snake peptide NA-CATH killed Y. pseudotuberculosis very well. Of the three chicken peptides, they all killed the bacteria under low-salt conditions (EC50 assay conditions). The only inactive peptides under these conditions were the two very small snake-derived peptides. Finally, we tested to see if each peptide can form pores in the bacterial membrane, to understand its mechanism of action. Data from this project can potentially be used in the future to create a new medicine to treat bacterial infections with antimicrobial peptides rather than treatment with antibiotics.

8: Kinetics of Chikungunya Virus Replication in Human small airway epithelial cells and Vero Cells

Britany Tang, Ashwini Brahms, Chelsea Pinkham, Lindsay Lundberg, Kylene Kehn-Hall
George Mason University

Chikungunya virus (CHIKV) is a re-emerging mosquito-borne virus endemic to Africa, Southeastern Asia, and the Indian subcontinent that has recently spread to Europe and the Americas causing large-scale epidemics. In humans, CHIKV causes high fevers with chronic muscle and joint pain. Currently, there are no FDA-approved treatments for CHIKV infection, prompting research to focus on investigating virus-host cell interactions in order to identify cellular factors important for therapeutic development. CHIKV has been shown to replicate in mammalian cells such as non-human cell lines (e.g. Vero cells, chick embryo cells, and BHK-21 cells), various human adherent cells (e.g. epithelial, endothelial, and monocytes), and human muscle satellite cells. This study sought to examine and compare the kinetics of CHIKV replication in Vero cells and Human Small Airway Epithelial Cells (HSAECs) via plaque assays to determine virus replication at various hours post infection. CHIKV was found to replicate at a higher rate and express more of a cytopathic effect in Vero cells than in HSAECs. Results suggest that the increased infectivity seen in Vero cells derive from the lack of an interferon response, compared to human small airway epithelial cells which have a normal interferon response. This data is important for setting up a reliable in vitro tissue culture model in which to study CHIKV infection.

9: Downregulation of Autophagy in U937 Cells in Response to *Yersinia Pestis* Infection

*Falen G. Yohannes[1], Farhang Alem[1], Kuan Yao[1], Douglas Lane[2], Valerie Calvert[3], Emanuel F. Petricoin[3], Martha L. Hale[2], Sina Bavari[2], Rekha G. Panchal[2], and Ramin M. Hakami[1]**
[1]National Center for Biodefense and Infectious Diseases and School of Systems Biology, George Mason University, Manassas, VA, USA [2]U.S. Army Medical Research Institute of Infectious Diseases, Frederick, MD, USA [3]Center for Applied Proteomics and Molecular Medicine, School of Systems Biology, George Mason University, Manassas, VA, USA

Yersinia pestis (Yp) is the causative agent of plague, responsible for major outbreaks that has killed millions and is classified as a Class A (highest priority) pathogen by the NIAID and the CDC. Yp has been used in the past for the purpose of bio warfare and there is strong concern over its potential use for acts of bioterrorism. There is no approved vaccine available for plague and early diagnostics and more effective therapeutics are also needed. Previously, we published on analysis of host response mechanisms in Yp-infected lung epithelial cells using RPPA (Reverse Phase Protein Microarray), revealing a number of novel protein level and phosphorylation changes of kinase driven pathways. Among the novel findings was activation of AKT and p53 proteins and deactivation of AMPK protein, suggesting a model of coordinated downregulation of autophagy in the infected host cells. We also showed, by functional assays, that negative regulation of autophagy does indeed occur in Yp-infected lung epithelial cells. We report here that the protein changes pointing to negative regulation of autophagy are similarly seen in Yp-infected human monocytic cell line U937. We also tested for whether a reduced conversion rate of LC3-I to LC3-II is observed in U937 cells, as we had found for Yp-infected human lung epithelial cells. LC3 is a protein marker for autophagy, with conversion from the LC3-I form to LC3-II signaling the initiation of autophagy. As observed in the lung epithelial cells, we found a dramatic reduction in LC3-I to LC3-II conversion, demonstrating that autophagy is strongly downregulated in U937 cells. The identification of such regulation during Yp infection is critical for a better understanding of how the infection progresses, and will assist in development of better and more effective countermeasure strategies.

10: Effects of an acute period of voluntary wheel running on contextual fear retention in female C57BL/6J mice.

Faysal Shaikh, Divya Geddam, Jessica Green, Kevin Hynes, Caroline Neely
George Mason University

Exercise has been linked to improvements in hippocampal activity. As described by Kohman et al. (2012), many studies involving exercise in both humans and animals have demonstrated benefits on hippocampus-implicated spatial learning and memory. Previous work (Clark et al., 2008; van Praag, Christie, Sejnowski, & Gage, 1999) utilizing C57BL/6J mice shows increases in hippocampal neurogenesis following voluntary wheel running. Contextual fear retention is a well-studied paradigm in behavioral neuroscience, examining conditioned anxiety and spatial memory. Previous work (Clark et al., 2008; Kohman et al., 2012) has shown increased freezing time-percentages in contextual fear retention for both male and female C57BL/6J. A different study utilizing adult male Fischer 344 rats (Greenwood, Strong, Foley, & Fleshner, 2012) also found increased freezing time-percentages in contextual fear retention. While the above studies examined additional factors or measures, no studies were found to examine effects of acute (in experimental periods shorter than 30 days) housing with running wheels.For this study, n=19 5.75-month-old female C57BL/6J mice will be divided into control (housed without running wheel) and experimental (housed with running wheel) groups. Following 18 days, mice will be subjected to a fear conditioning paradigm, and freezing time-percentages to context will be measured 24 hours later. We expect mice subject to housing with running wheels will exhibit stronger contextual retention of fear memories, as indicated by greater freezing time-percentages, than those subject to housing without running wheels. These results may indicate benefits of acute voluntary exercise activity on hippocampal memory.

11: Antibiotic Synergy to Combat Drug Resistance in Acinetobacter baumannii

Jaimarie L. Episola, Monique L. van Hoek, Stephanie M. Barksdale
George Mason University

Acinetobacter baumannii is a Gram-negative bacterium that acts as an opportunistic pathogen and is often found in hospital environments. In 2013, the Center for Disease Control estimated 12,000 cases of A. baumannii occur each year; 63% of those cases were multidrug resistant. Due to antibiotic resistance, treatment options are becoming limited for Acinetobacter baumannii infections. Recently, the World Health Organization listed carbapenem-resistant A. baumannii as a pathogen of critical priority for new antibiotics. However, a combination of antibiotics could also overcome resistance and kill the bacteria. This study will investigate the synergistic effects of antibiotics on multi-drug resistant (MDR) A. baumannii. We determined the individual minimal inhibitory concentration (MIC) of eight antibiotics " amikacin, ampicillin, ciprofloxacin, doxycycline, colistin, rifampin, and tetracycline " on the growth on A. baumannii ATCC 9955 (a sensitive strain) as well as A. baumannii ATCC BAA-1794 (an MDR strain). All but ampicillin were extremely effective against A. baumannii 9955. However, A. baumannii ATCC BAA-1794 was only susceptible to rifampin and colistin. Next, we performed assays to detect synergy in different antibiotic combinations. Fractional inhibitory concentration (FIC) was determined by checkerboard assays. The detection of synergy will expand the treatment options of infections caused by MDR A. baumannii.

12: Effect of Tunicamycin on Idiopathic Pulmonary Fibrosis Fibroblast Apoptosis

Luc Tran, Sarah Bui, Geraldine Grant
George Mason University

Idiopathic pulmonary fibrosis (IPF) is a fatal lung disease that is characterized with scarring of the lung tissue over time and increased collagen deposition. Previous unpublished data has shown that IPF fibroblasts are more resistant to apoptosis when exposed to a combination treatment of curcumin, aspirin, and sulforaphane. One possible explanation for this resistance is that IPF fibroblasts choose to primarily go through glycolysis instead of oxidative phosphorylation. In a study done by Tomiyama et al., oxidative phosphorylation is required to activate the Bax-Bak pathway for cell apoptosis. By avoiding oxidative phosphorylation, the IPF fibroblasts essentially turn off this apoptotic pathway. Further evidence points to an elevation in lactic acid concentration in IPF tissue, which suggests a preference of the IPF fibroblasts to exhibit lactic acid fermentation rather than oxidative phosphorylation (Kottmann). Normal (n=5) and IPF (n=10) human lung fibroblasts, extracted from primary patients, were exposed to 80 ÂµM of tunicamycin over 24 hours. Normal and IPF fibroblasts were pre-treated for 72 hours prior to tunicamycin challenge in high or low glucose media to shift the fibroblasts towards oxidative phosphorylation by decreasing the amount of free glucose in the media. It was hypothesized that the IPF population will be more resistant to apoptosis when treated with tunicamycin and oxidative phosphorylation will sensitize the IPF fibroblasts to go through apoptosis. Fibroblast survival was quantified by Cell Titer Glo Assay. Expression of glycolytic regulatory enzymes, pyruvate dehydrogenase kinase I (PDK1) and pyruvate dehydrogenase kinase III (PDK3) were analyzed by Q-PCR.

13: Pollen Diversity and Disease Susceptibility in Common Eastern US Bumble Bees (Bombus)

Lynn Bonomo, R.E. Forkner, Celia Vuocolo
George Mason University

Important pollinators, such as honey bees and bumble bees (Bombus), are declining globally. Scientists attribute declines of Bombus in the U.S. to a gut pathogen, Nosema. In fact, Nosema may be responsible for the loss of Bombus affinis, a species recently protected under the Endangered Species Act. No published studies exist regarding the epidemiology of this fungal pathogen in natural environments. Because Bombus workers do not overwinter, they must acquire infections from the environment or from colony-founding queens. Flowers are a potential environmental source of infection for both queens and workers, and Bombus species often share floral resources. Therefore, workers or species that forage more often or on a greater diversity of flowers may be at greater risk of Nosema-related decline. To test this, we collected Bombus workers from five locations in 2016 and assessed them for pollen load, pollen diversity, and Nosema infection load. Pollen was identified using fuchsin staining and Nosema spores were counted using phase contrast microscopy. Pollen diversity did not correlate to Nosema infection due to high levels of site-specific pollen preferences and low levels of infection in the Bombus species examined. Future work will examine infection rates in founding queens and will increase the sample sizes of workers collected to improve our ability to statistically relate pollen diversity to pathogen infection.

14: An examination of rodent-human social interaction and depressive behavior in laboratory mice

Matthew Decoito, Iram Saqib, Brian Otoya, Ga-Hee Kim

Social enrichment and interaction are an important aspect of a laboratory animal's wellbeing. Handling is one technique that is important to enhance animal well-being; unfortunately, handling is often overlooked in experimental designs. Cage transfer by the tail and poor handling can cause unwanted or extraneous anxiety and stress (Gouveia and Hurst, 2013). Restraint-free handling, during which a mouse can freely walk on the researcher's hands, decreases anxiety after multiple handling sessions (Hurst and West, 2010). This study sought to assess the effect of handling on decreasing depression, a condition that is highly comorbid with anxiety. We expected that animals who were handled and had physical contact with the researcher over four days would exhibit decreased depression compared to non-handled animals. Twenty-three 8-week-old male C57BL/6J mice were split into two conditions. The first condition (n = 12) contained mice who were not handled by a researcher. The second condition (n = 11) contained mice who were handled by the same researcher. After four days, we conducted the Forced Swim Test (Porsolt et al., 1977) to assess depressive-like behavior. Our data showed that the handled group spent less time immobile (M = 98.01, SD = 59.05) compared to the non-handling group (M = 107.19, SD = 42.68). An independent samples t-test did not yield statistical differences in depressive-like behavior, $t(21) = 0.424$, $p = 0.676$. Further expansions of this study, such as a longer time frame for handling before behavioral testing and additional behavioral assays that examine anxiety may shed light on the importance of handling and animal well-being. It is possible that short-term handling is not sufficient in alleviating depression and anxiety in response to human researchers and stressful behavioral testing. Social enrichment, which includes social housing and better rodent-human interactions, may produce better data as well as combat anxiety-related health risks in laboratory animals. Most importantly, this line of research provides suggestions for improving housing and care standards in animal testing.

15: Animal model for human substance abuse

Mena Mohamed, Liuwork Habtemichael, Ali Zaidi, Najaf Khan
George Mason University

Scientists aim to utilize animal models with sound construct and predictive validity, with the intention of discovering treatments for neuropathological conditions. Few studies have evaluated the translatability of food addiction in mice to substance abuse in humans. Food addiction has the potential to mimic drug addiction, because brain pathways that evolved to respond to natural rewards are also activated by addictive drugs (Avena et al., 2007). Sugar addiction in rats has been linked to higher chances of developing ethanol addiction (Carrillo et al. 2004). There are no studies on sugar addiction to induce and mimic substance addiction, withdrawal, and anxiety. This study aims to explore the validity of utilizing sugar addiction as a model for substance addiction in humans. Male C57BL/6J mice (N = 17) were randomly divided into different groups: treats were not placed in the cages of the control mice, whereas the experimental mice were exposed to sugary treats. After 21 days of treat administration, mice will undergo the Open Field Test (OFT) which examines behavioral anxiety (Brielmaier et al., 2007). We expect mice exposed to sugary treats will display increased behavioral anxiety as measured by the OFT, whereas control mice not exposed to the sugary treats will display decreased behavioral anxiety. Overall, we expect to see a relationship between exposure to sugary treats and anxiety. This study has the potential to emphasize the significance of healthy environments in the plight to combat the addiction epidemic that affects the lives of many people worldwide.

16: NeuroMorpho.Org: The Study of Neuronal Morphology Through Digital Reconstruction

Miranda Ayhan, Farishta Boura, Deyra Carranco, Emily Metz,
Kaitlyn Power, Fatima Siddiqui
George Mason University

In all biological systems, form denotes function. Neuronal morphology is important in the understanding of the nervous system. Morphology examines the cellular level of neuronal anatomy and its functional mechanisms. Understanding how populations of neurons encode information and guide behavior is a major focus of systems neuroscience. More data on the morphologies of neurons leads to deeper conceptual understandings in regards to the brain. Currently, the standard for quantifying cellular neuroanatomy is through three-dimensional digital reconstructions. These digital files are standardized and centralized in NeuroMorpho.Org, the world's largest database of publicly available digital reconstructions of neuronal morphologies.NeuroMorpho.Org is a user friendly web-based platform for freely sharing these data in an expert system online. The accumulation of neuromorphological tracings generated every day is growing exponentially. By compiling this information, the data can be better utilized world-wide by allowing large scale analyses and international collaboration to answer more and bigger questions about neuronal morphologies. As Data-Processors, we use both automation and manual editing to standardize and correct data received from laboratories around the world. Once pre-processed, inspected, edited as needed, error-checked, and post-processed, the data are ready to be uploaded onto the website. All neurons are accompanied by details on the animal species, brain region, cell type, and the experimental collection methods. Ultimately, big data neuroscience and the processors who curate every single neuron enable the formation of connections all across the neuroscience community.

17: Comparison of Gut Microbial Community Across Bumble Bee Castes

Nadine Carcamo, Rebecca E. Forkner, Masoumeh Sikaroodi, Swati Dalmet, Celia Vuocolo, Patrick M. Gillevet
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Colonies of bumble bees, Bombus, consist of three castes (queens, workers and males) which have different diets. Diet influences the gut microbiome; therefore, we could expect variation to exist in gut microbiome composition across castes, possibly affecting the bees' overall health. The aim of this project was to describe these differences in gut microbiome across castes and species of Virginia Bombus. To do this, DNA was extracted from bees' gut and the first two variable regions of the 16s rRNA gene were amplified using universal bacterial primers in PCR. The bacterial community was surveyed by LH-PCR fingerprinting and then the PCR products were sequenced using Next-Gen sequencing with Ion Torrent technology. Our preliminary analyses using the RDP 11 Bayesian Classifier show that bacteria of the genus Gilliamella was the most common across all castes. Principal coordinate analysis also showed that workers differed in gut bacterial composition from males and queens. Learning more about the bacteria could give insight into the relationship between these bacteria and bumble bee health and colony survival.

18: Design of a Cellular Platform for Pharmacological Screening in Spinal Cord Regeneration

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The intention of this project was to design several iterations of microfluidic platforms whereby a great variety of neurological regenerative experiments could be performed. Development of microfluidic devices are only recently being utilized in the biological sciences due to the technology necessary for creation becoming more readily available. Working with a newly acquired highly advanced laser based apparatuses and sequential refinement of the device along several stages of the creative process allowed for a viable apparatus for severing neurons. Once the resulting design's viability was assessed the examining of regeneration began to take shape. Research and development of platforms at the microscopic level for the purposes of inducing specific cellular response are at the first phases of progress among the scientific community. This project sets out to build upon the works of others in the field while focusing on neuronal regeneration, specifically the biochemistry to do with alpha 7 nicotinic receptors. Achievements were made through reviewing other microfluidic research and modifying their designs to fit the purposes of neuronal growth, axon channeling and severance. With the formation of this device further testing and full scale pharmacological screenings will begin to take place for the advancements of neurobiology at scales not yet encountered.

19: The Effect of Dietary Copper and Zinc Manipulation on their Respective Cellular Availabilities, Inflammation, and Certain Behaviors in Late Alzheimer's Disease in Mice Models

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Alzheimer's Disease (AD) is among the top 10 causes of death in the United States, and currently affects close to 5 million Americans. (Alzheimer's Facts and Figures, 2016). Although various studies have been conducted on AD, the cause has yet to be determined. Much of the research is focused on Early Onset AD (EOAD), but most cases reported in the United States of Late Onset AD (LOAD), this is because there is relatively more information available for EOAD, as opposed to LOAD. With the disease's current understanding, amyloid beta plaques are thought to cause the disease. Amyloid beta plaques form from larger amyloid precursor protein (APP), and interfere with cell signaling, causing inflammation (Selkoe 2001; Savelieff et al., 2013). In addition to that, the plaques may also negatively affect metal ion homeostasis, causing the problems mentioned above. For the current study, Late Onset AD will be modeled using mice models. The mice models were created by crossing mice containing an E4 allele of apolipoprotein (APOE) with mice containing a mutated APP. To specifically study the plaques effect on metal ion homeostasis, copper and zinc will be added in varying amounts to their diets. The mice will observed for any memory impairments, or behavioral abnormalities. According to the data from the George Mason University's Neuroscience lab in rats, increased levels of dietary zinc may negatively affects memory, and have effects similar to a copper deficient diet. To test this angle, three dietary conditions will be assigned to APP/E4 mice and wild type control mice: copper deficient, control, and zinc enhanced. The mice will also be evaluated for any cognitive abnormalities. These evaluations will test their abilities to burrow and nest, because these behaviors represent activities of daily living. After these tests are taken, the mice will be sacrificed, and levels of cellular proteins, ZNT-3 (zinc) and Ctr1 (copper), will be measured by Western blot analysis.

20: Fetal Microchimerism in Mus Musculus

Rabail Hussain, Valerie Olmo
George Mason University

In this study, pregnant female mice will be studied in order to assess the degree to which fetal cells have gathered into the maternal tissues (a process called fetal microchimerism). It has been found that, in human females, during pregnancy, fetal cells distribute to almost every major organ in the mother's body, particularly the heart, lungs, kidneys, and breast tissue (Rijnink et al. 2015), as well as areas of the body that had experienced tissue damage (Mahmood et al., 2014). It has been speculated through previous research that the fetomaternal cell movement in humans is evolutionarily driven due to the increased parental reliance human offspring have on their parents (Boddy et al. 2015). A study showed that fetal cells are not present in mice postpartum (Dawe et al. 2007), whereas in humans they remain for decades after birth (Boddy et al. 2015). This implies that animals with lower parental reliance do not waste resources in processes that are not evolutionarily beneficial. In this study, the liver tissue of female mice in which liver damage has been induced will be compared to the healthy liver of pregnant female to assess whether there is a significant difference in the presence of fetal cells, tracked by the paternally inherited GFP+ in the fetal cells. Undamaged kidney tissue will also be examined from both control and sample groups to establish the base level of fetal cells expected to be seen on undamaged tissue.

21: In Silico Discovery of Inhibitors for SLC25A1 as a Target for Lung Cancer

Rachel Carter, Carissa Hunter, Michael Girgis, Kyung Hyeon Lee, Youssef Khalafallah, Maria Laura Avantaggiati, Mikell Paige
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Cancerous cells develop due to genetic mutations acquired by the cell. Targeted cancer therapies are able to treat the specific genetic mutation present in a patient's cancer cells by targeting either the mutated gene or the gene's protein product. SLC25A1 is a protein that is overexpressed in some cancer cells due to mutations of the SLC25A1 gene, and has been shown to be responsible for tumor growth and proliferation. SLC25A1 is a mitochondrial transmembrane protein that transports citrate out of the mitochondria, and is integral for maintaining mitochondrial integrity. It was hypothesized that SLC25A1's function could be blocked by a chemical inhibitor that would attach to the protein's binding site, thereby preventing citrate from binding. Previous studies have shown that inhibiting SLC25A1's function destabilizes the mitochondria, and leads to autophagy. For this project, the goal was to identify new, more potent chemical inhibitors that could be used as a practical and cost-effective treatment for cancer patients. The first stage of the research project consisted of computational analysis to find potential inhibitors. Two programs, Chimera and DOCK 6.7, were used to screen multiple databases of chemical molecules for binding affinity to the homology model of SLC25A1 in silico. Two compounds, 2-[(2S)-3-acetyl-4-hydroxy-2-(4-methoxyphenyl)-5-oxo-2H-pyrrol-1-yl] acetic acid and Valsartan, were identified as potential inhibitors for SLC25A1. The second stage consisted of testing SLC25A1's function. SLC25A1 was expressed and purified in E. coli., and liposomes were created to simulate the mitochondrial membrane. The transport of citrate by SLC25A1 across the membrane was measured using Europium-Tetracycline fluorescence. Future studies will focus on testing the effectiveness of the identified inhibitors by using this method to measure the amount of citrate that passes across the membrane after the addition of the chemical inhibitors.

22: The Use of Histones as Biomarkers in Stimulated Alligator Blood.

Ryan Pohle, Jaclyn D'Onofrio, Shaylyn Scott, Paul Russo, Barney Bishop
George Mason University

Cationic antimicrobial peptides (CAMPs) are a component of the innate immune response in most mammals and are a potential source of potent human antimicrobial therapeutics. The BioProspecting approach to CAMP discovery utilizes novel hydrogel microparticles to capture small peptides with CAMP-like properties, from other, larger peptides in the plasma. Of these captured particles, one of the most common peptides captured is histone fragments. These highly conserved domains can be tracked in different blood stimulations using the BioProspecting approach. These histones can then hopefully be utilized as biomarkers, or unique and traceable fragments that are easily identified within the blood. Blood was stimulated from alligator mississippiensis by heat killed pseudomonas aeruginosa (HKPA), lipopolysaccharides (LPS), or left unstimulated. The samples were searched for these histone fragments using a homegrown histone database. These were then compared and searched for unique peptides in each stimulation to determine a possible histone fragments that could be used as a biomarker peptide for disease.

23: Top-Down Modulation of Expectation on Physiological Arousal and Cognitive Performance under Blue-Enriched Lighting Conditions

Stephen James Guion, John J. Graybeal, Craig G. McDonald
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The current study will investigate blue-light exposure's influence on physiological and psychological arousal during daytime hours and whether expectancy significantly moderates performance. Environmental and artificial light drives specific physiological processes. Melanopsin-expressing intrinsically photosensitive retinal ganglion cells in the eye respond to light stimuli directly and are sensitive to wavelengths near 480nm. Activation of these cells drive endocrine and neurotransmitter signaling influencing alertness and arousal. Preliminary studies provided evidence that short wavelength light can induce increased arousal subsequently increasing individual performance on cognitive tasks. Further research demonstrated the effects of blue-light exposure are independent of time, whether at night or day. Expectancy is a variable not well considered in previous research pertaining to the presence of expectancy effects. Expectancy effects, such as placebos, have the ability to alter both the mind and body of a participant. The study seeks to build on previous research by focusing on performance and arousal under different lighting conditions with controlled expectancy. A between groups design will be used, in which each participant will be exposed to either blue-enriched and blue-depleted light. The lighting conditions will be matched in terms of lux, but the spectral compositions will differ in terms of blue-wavelength irradiance. Eighty participants will be recruited through online systems and will be randomly assigned to a control or expectancy condition. Galvanic skin response and electrocardiography will be used to monitor physiological arousal. Trials will include an auditory vigilance task, questionnaires, and rating scales to assess alertness, visual comfort, and subjective arousal. Correlational and regression statistics will be conducted. Expected outcomes are that participants who were exposed both to blue-enriched lighting and expectancy will demonstrate an increased physiological response, alertness level, and cognitive performance compared to other conditions. The findings from this study will contribute to the literature by incorporating expectancy as a covariate.

24: Fish community composition and diet changes after a regime shift in Gunston Cove, VA

Tanya Traeger, Casey Pehrson, Kim de Mutsert
George Mason University

The Chesapeake Bay is the largest estuary in the United States. Gunston Cove is a tributary of the Potomac River, a major sub-estuary of the Chesapeake Bay. Long-term efforts to improve the water quality of Gunston Cove have changed the system from a phytoplankton dominated to a submerged aquatic vegetation dominated state. These efforts and habitat changes combined with an increase of non-native fish species such as the Blue Catfish (Ictalurus furcatus) have changed the makeup of the native fish population, and has likely caused shifts in the consumption patterns. This study explores the stomach content of two native fish species, bluegill (Lepomis macrochirus) and pumpkinseed (Lepomis gibbosus), and of the non-native blue catfish (Ictalurus furcatus). A total of 27 pumpkinseed, 19 bluegill and 11 blue catfish were collected and dissected from Gunston Cove during the months of August and September 2016. The results will be compared to previous diet studies to determine how the diets of each fish have been altered due to changes in environment. This in combination with an analyses of changes in population structure will provide information on whether competition and/or habitat changes has changed the community structure and consumption patterns of native fishes. Future directions include sequencing each prey item using DNA barcoding. This method provides a more precise identification of each item, particularly those that are highly digested and difficult to identify via taxonomic analysis.

25: Analysis of Arsenic exposure in antibiotic users in the U.S.

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Studies have shown that the gut microbiome metabolizes arsenic. Studies have also shown that antibiotic intake can affect the gut microbiome's composition. Exposure to different arsenic species has not been analyzed between antibiotic and non-antibiotic users in a large US study. Our objective was to investigate the arsenic species exposure measured in urine samples of antibiotic users and non-antibiotic users. The sample population was determined through the National Health and Nutritional Examination Survey (NHANES) which is a national database that contains information about the overall health of the U.S. population. Data were collected in data cycles from 2003-2012. A sample of 11,492 participants who had data for urinary arsenic species and other information was analyzed. There were 485 participants in the sample population who had taken antibiotics in the past 30 days. The data were organized and compiled in Stata Â® then statistically analyzed using linear regression to evaluate for mean differences in arsenic species across antibiotic users and non-users.The total arsenic level in antibiotic users were lower than that of the non-antibiotic users with the average of 17.498 Î_g/L compared to 18.495 Î_g/L of the non-antibiotic users. There was no significant difference in arsenic levels of antibiotic users compared to non- antibiotic users, unadjusted or after adjustment for age, sex, race, education, smoking, and income to poverty ratio. Although total urinary arsenic levels were lower in antibiotic users than non-antibiotic users, the difference was not statistically significant. This study was limited by the small sample size of antibiotic users and low arsenic exposure in the population. Further studies should focus on the metabolized arsenic species along with the associated bacterium(a) to determine any influential factors.

26: Study to Determine the Effects of Resveratrol on the Blood Serum Levels of Estrogen, Estrone, Estrone Sulfate and Estradiol in Female Patients with Cytochrome P450 Genetic Variations

Yasamin Rahmani, Ancha Baranova
George Mason University

The American Cancer Society has reported that breast cancer is one of the major public health problems in the United States. Between 2005-2009, over 230,000 females were affected by breast cancer from which almost 40,000 cases lead to mortality. Breast cancer is one of the four major cancers along with lung, colorectum and prostate. It is estimated that 1 in every 8 females will be affected by breast cancer in their lifetime. Certain genetic mutations, associated with estrogen metabolism, have been linked to the production of metabolites that damage DNA leading to the formation of cancer cells. These metabolites have been linked to an imbalance of estrogens, specifically estrone (E1), estrone sulfate (E1S), and estradiol (E2). With enzymatic activity of cytochrome P450 (CYP), CYP1A1 metabolizes estradiol into 2-hydroxyestradiol (2-OH-E2), while CYP1B1 metabolizes both estradiol and estrone into 4-hydroxyestradiol (4-OH-E2). Overproduction of 4-OH-E2 has been linked to the formation of squamous cell carcinoma due to its binding to the DNA. Such characteristic is due to its radicalized form once it undergoes Phase I liver detoxification. Resveratrol, a polyphenolic compound, naturally found in grape skin, berries and other sources, is thought to have protective chemopreventive and chemotherapeutical properties. This research is focused on investigating how resveratrol acts as a competitive inhibitor and slows down the enzymatic process in Phase I of the liver detox pathway. Such properties of resveratrol have been observed in vitro but in this study, it will be taken a step further and observed in vivo. The study will observe the effect of resveratrol on the enzymatic activity of the cytochrome P450 enzyme variation of CYP1A1 and CYP1B1 in respect to the levels of estrogen, estrone, estrone sulfate and estradiol.

27: Solitonic basis for neuronal communication

Youssef Faragalla, John R Cressman
George Mason University

The current model for nerve impulse propagation, the Hodgkin-Huxley model, does not fully explain the mechanical components of the action potential. By comparison, an alternative model for the action potential " the soliton model "is based on a propagating phase transition in the neuronal membrane. This model explains observed changes in lipid membrane properties during action potential propagation; and can perhaps aid in developing non-pharmacological treatments to neurological disorders, which are not fully explained by the Hodgkin-Huxley model. We intended to determine whether solitonic propagation is energetically advantageous in comparison to Hodgkin-Huxley type propagation. In addition, we investigated whether the mechanical displacements observed in neuronal cells during the action potential are related to solitonic or saltatory conduction and whether osmotic fluctuations are capable of generating solitons in neuronal membranes. This review intends to survey the nature of the action potential in a holistic manner; intending to understand the mechanical and thermodynamic elements of the action potential and their importance in its propagation.

29: Semi-synthesis of novel non-immunosuppressant FKBP inhibitors

Brendan Gallagher, Karl Battams, Robert Weigel
George Mason University and Naval Research Lab (Karl Battams)

FK506-binding proteins (FKBPs) are the natural ligands of FK506 (tacrolimus) (Gaali et al., 2015). Several FKBPs are found in humans and are thought to play a role in several diseases such as lung fibrosis and Alzheimer's disease. It is well known that the FKBPs-FK506 complex has a site that binds to calcineurin, which suppresses the immune response in humans. It is also known that the disruption of the calcineurin binding site of FK506 does not affect its activity toward FKBP binding (Staab-Weijnitz et al., 2015). BoDIPY, a fluorescent tag, was added to the calcineurin binding site of FK506, potentially inhibiting the immunosuppressant effects. BoDIPY was synthesized using a published procedure that was slightly modified (Chen, Zhao, Guo, & Xie, 2012). The semi-synthesis approach was conducted using a Heck coupling reaction between a halogenated BoDIPY and FK506 compound catalyzed by Pd(OAc)2 and SPhos. Pd(OAc)2 and SPhos are novel catalysts for this reaction. The fluorescent FK506 analogue can be used to diagnose and detect FKBPs involved in various pathogenic states. For example, in pulmonary fibrosis, FKBP10 is exaggeratedly overexpressed and it is speculated to be involved in the phenotype. The fluorescence FK506 analogue can be used for flow cytometry cell count experiment for animal model studies. It can be also used for cell imaging tool for molecular level studies. FKBPs are involved in a variety of pathological mechanisms. This illustrates the significant value and potential benefits of using the fluorescent FK506 analogue in future research.

29: A Global Survey of EUV Solar Corona Power Spectra

Brendan Gallagher, Karl Battams, Robert Weigel
George Mason University and Naval Research Lab (Karl Battams)

The focus of our project was an investigation into oscillations in the solar corona. Previous research has shown that power spectra computed from time series of intensity values from the solar corona can be modelled by a general background power law representing a combination of stochastic processes, with an added 'tail' discerning the transition to white noise. Recently, work by Ireland et al. has proposed a more comprehensive spectral model that includes an additional superimposed Gaussian component to reflect regions or features that may contain a local oscillatory source. We extend the work of Ireland et al., who demonstrated that the averaged power spectra of selected regions in the solar corona display different characteristics, to perform the first global survey of power spectra of the extreme ultraviolet (EUV) solar corona. The dataset we chose to investigate was a massive 1000x1000-arcsecond region, composed of five wavelengths: 171A, 193A, 211A, 304A, and 1600A, and spanning 12 hours on June 26th, 2013. We find that across all wavelengths in our investigation, that each model parameterization distinctly reflects the regions' visually observed features. We classify spectra into three main categories - power law-dominated, tail-dominated, and those with a significant Gaussian component - and associate these spectral categories with the physical characteristics of the regions they correspond to – turbulent, quiescent, and periodic, respectively. Through examination of the variation in parameters from one wavelength to the next, representing a change in the observed layer's height and temperature, we derive insight into the how the physical processes that determine the conditions in each layer are transmitted from one layer to the next. Our research yields several promising possibilities for future study, including automated feature detection, as well as the detection of the precursor conditions leading up to significant solar events such as sunspot emergences and solar flares.

30: A noninvasive inductance sensor for the measurement of nanoparticles

Brittany Rapp, Abul Hussam
George Mason University and Centre for Clean Water and Sustainable Technologies

Nanoparticle analysis currently does not include many studies evaluating the effects of colligative properties on inductance. Commercial inductance-to-digital converter (LDC) sensors are utilized as a noninvasive method of detecting nanoparticles. Nanoparticles are detected based on physical properties including conductance and concentration. Based on this assumption, the project aims to show increasing the concentration of magnetic nanoparticles correlates to greater inductance compared to non-magnetic nanoparticles by evaluating the inductive effects of magnetic and non-magnetic oxide nanoparticles as a function of concentration. The change in inductance due to increased concentration of TiO2 and Fe3O4 nanoparticles is measured with an IDC sensor (Model LDC 1312/1612 EVM Texas Instruments). The results show magnetic Fe3O4 nanoparticles provide greater inductance changes compared to TiO2 as a function of concentration. The sensor detected 267 g to 3738 g Fe3O4, with a detection limit of 448 g and sensitivity of 1.20 x 10-5 H/g for 50 nm particle size. For nonmagnetic TiO2 nanoparticles, the sensor detected 502 g to 4522 g with a detection limit of 476 g and sensitivity of 3 x 10 -7 H/g for 100 nm particle size. Future experiments involve measurement of transient-inductance to reveal the kinetics of nanoparticle formation from reactants which are nonmetallic and nonmagnetic.

31: Chua's Circuit: Analyzing Power Fluctuations in a non-Equilibrium Chaotic System

Chris Carlson, John Cressman
George Mason University

Non-equilibrium systems are systems that are in contact with two reservoirs that are not in equilibrium with each other, there by permitting a sustained flow, such as mass or information, through the system. These systems are not yet well understood, and the goal is to study one aspect of these systems, namely the statistics of power fluctuations. The focus of the study is on Chua's circuit, a non-equilibrium system with non-linear characteristics. Chua's circuit can be described by three differential equations, including a nonlinear component. Using a Kalman filter, a model for the circuit has been tested along with data from the physical system. Using the model, non-equilibrium theories, based on the statistics of the power fluctuations, will be tested and verified.

32: Developing Novel Antibiotics Targeting the MEP Isoprene Biosynthetic Pathway

Claire Johnson, Amanda Haymond, Haley Ball, Cynthia Dowd, Robin Couch
Cynthia Dowd; Department of Chemistry George Washington University

Antibiotic development is essential due to natural and engineered antibiotic resistance. The organisms I use are Yersinia pestis, Francisella tularensis, and Mycobacterium tuberculosis. M. tuberculosis causes tuberculosis, and two antibiotic resistant strains, multidrug resistant TB and extensively drug resistant TB, create a major world health concern. The others are biothreat agents, and the National Institute of Allergy and Infectious Diseases has warned that they pose a significant threat, as they are extremely contagious with high mortality rates. In antibiotic development, it is important to select a protein target necessary to the pathogen for survival or growth. IPP and DMAPP are molecules essential to living organisms, and blocking production would be fatal. There are two distinguishable pathways used by organisms to produce IPP and DMAPP; humans use the mevalonate (MVA) pathway, whereas most gram-negative bacteria use the methylerythritol phosphate (MEP) pathway. Blocking the MEP pathway in Y. pestis, F. tularensis, and M. tuberculosis makes an excellent target for antibiotics. The MEP synthase enzyme has been validated as a drug target in a variety of studies. By inhibiting this enzyme, it is possible to eliminate production of IPP and DMAPP in bacteria, thereby killing the pathogenic microbe. An ideal inhibitor blocks the enzyme at a low enough concentration that its presence is not toxic to humans. The most efficacious inhibitors show the least enzyme activity. This project uses rationally designed inhibitors, and through analysis of various assays, will determine which inhibitor is a candidate for further antibiotic studies.

33: Identification of Anti-HIV Phytochemical from Plant Extract

Grey Madison, Haley Ball, Taryn Brooks-Faulconer, Yuntao Wu, Robin Couch
George Mason University

Plants provide a diverse and unique source of phytochemicals; and consequently, they have been used for centuries for the treatment of illness. The metabolites produced by plants generally fall into two major categories; those involved in primary metabolism and those that are secondary metabolites. Secondary metabolites are often unique to a plant, and are typically the source of its medicinal properties. Modern biochemical techniques/instruments such as Liquid Chromatography-Mass Spectrometry (LC-MS) permit the identification of specific phytochemicals responsible for the medicinal activity of a plant. In this research project, a plant extract demonstrating anti-Human Immunodeficiency Virus (HIV) properties (originally identified by Dr. Yuntao Wu at George Mason University) was examined to identify the metabolite responsible for its activity. Molecular size fractionation was used as an initial step to concentrate and purify the phytochemicals. An LC-MS based protocol was developed and used next to identify key metabolites within the plant extract. ViroVisionâ„¢ Rev-A3-GFP/Luc HIV reporter cells (infected with pNL4-3 plasmid) were used for the bioassay, with the potency of the isolated phytochemicals being assessed via flow cytometry. Our current progress is reported on this poster.

34: Adsorption of emerging contaminants, carbamazepine, onto humic acid and clay: Equilibrium isotherms and effect of the water matrix

Jasmine Alizadeh-Saei, Sabrina Barkat, Marjan Alaghmand
George Mason University

Carbamazepine (CBZ) is an antiepileptic drug that is not easily degraded in the environment. The removal of this emerging contaminant, CBZ, dissolved in distilled water and wastewater matrices by means of their adsorption onto humic acid and clay has been investigated. The effect of various parameters including adsorption time, adsorbent dosage and initial adsorbate concentration were determined. The optimum exposure time for the removal of CBZ by humic acid and clay was 30 minutes and two hours, respectively, in both distilled and wastewater. The maximum percent removal of CBZ by humic acid and clay in distilled water was 86.5Â±3.1% and 88Â±10.5%, and in wastewater, was 75.4Â±1.5% and 78.2Â±1.2%, respectively. The maximum CBZ loading capacity for humic acid and clay were 3.87 mg/g and 3.08 mg/g from distilled water and 3.57 mg/g and 1.69mg/g from wastewater, respectively. Three isotherms models including Langmuir, Freundlich, and Elovich were applied to the experimental data and analyzed. It was found that the adsorption isotherms for the three adsorbents best matched Langmuir model indicating surface adsorption from distilled water (R2= 0.986 for humic acid and R2= 0.865 for clay) as well as from wastewater (R2= 0.893 for humic acid and R2= 0.984 for clay). According to the kinetic studies the pseudo-second order kinetic model better fits to the removal of CBZ by the three adsorbent from the two water matrices.

35: Generation of recombinant dehydratase domain of FK506 biosynthase as a tool for non-immunosuppressant PPIase inhibitor production

Joanne Ji Hyun Min, Young-Ok You
George Mason University

DNA cloning plays an important role in many genetic engineering approaches to biotechnology research. There are numerous steps involved in cloning a gene, including polymerase chain reaction-amplification of the gene of interest from template DNA, restriction enzyme digestion of amplified DNA and plasmid DNA vector, ligation of DNA with plasmid DNA, transformation of the resulting DNA into a host cell, and DNA gel electrophoresis. The dehydratase enzyme domain (DH6) that plays an important role in biosynthetic pathway of immunosuppressant drug FK506, also known as tacrolimus or fujimycin, was extracted from Streptomyces tsukubaensis and cloned for future study. DH6 locates on FkbC gene, which is one of three central genes that is essential for multifunctional FK506 polyketide synthase. Continuing studies on the biological action and mechanism of DH6 on FK506 using recombinant DNA from cloned product will empower the production and development of more effective pharmaceutical treatment for many transplant surgeries, such as kidney or heart transplantations.

36: A Survey of Entropic Gravity

Khunsa Amin, John Robert Cressman
George Mason University

Our work aims to investigate the idea of entropic gravity, and to better understand this concept being presented. This idea of entropic gravity is motivated by Bekenstein's thought experiment and extrapolated to a holographic surface. The black hole is replaced by a 2D holographic screen and, similar to the idea behind Hawking Radiation, a particle is brought near the screen; it travels in the emergent direction, i.e. from the macroscopic side to the microscopic. Before the information of this particle is absorbed into the microscopic side of the screen, the overall macroscopic structure of the screen is altered in some way. So while similar to the case of a black hole in that the information on a microscopic level is lost to us, we are able to extract information based on the change in the macroscopic structure of the screen. This concept is analogous to the example of a polymer in a solvent and one of our goals is to relate these two ideas, so as to use the more well-known polymer model to explain qualitatively the situation being presented in the Bekenstein thought experiment, and through that, to the holographic case. The second goal is to be able to disseminate the information in a more accessible way, so as to foster more of an understanding for this idea of entropic gravity.

37: Using Literature-Based Discovery in Medicine to Discover Links Between Disconnected Knowledge Domains: Cholera, Breast Cancer, Alzheimer's, and Diabetes

Nicky Solares, Mariela Jennings, Nahzic Saloman, William McCarty, Akhila Kandimalla
George Mason University

Though advanced research in the medical field is being conducted in every part of the world, it is becoming increasingly difficult for the discoveries being made to become a part of a greater network of common knowledge. While abundant research is being published to widely known journals, the evident division of different subcategories is preventing hidden connections from being discovered because little effort is dedicated to connecting the separate pieces of knowledge obtained by researchers working in disconnected institutions. Through meticulous searches of the published journal articles related to medical conditions of great importance, it is possible to uncover hidden connections that remain invisible to researchers whose primary focus is in one field. For this project, literature-based discovery methods were combined with targeted extraction of antecedents and consequents from sentences based on well-known causation structures in the English language. The results proved that analysis of available publications can reveal connections between seemingly disconnected domains of research such as breast cancer, Alzheimer's disease, diabetes, and cholera. While such connections were uncovered through the efforts of this team, it is possible to design an algorithm to automate the process so that connections between existing research can be uncovered in a more efficient manner, and this approach can be extended to any domain of knowledge.

38: In search of Tiny Giants: Finding Supermassive Black Holes In Low Mass Galaxies

Ryan W. Pfeifle, Shobita Satyapal, Mario Gliozzi, Nick Abel
George Mason University and University of Cincinnati (Nick Abel)

Over the last one hundred years, we have discovered supermassive black holes (SMBHs) on the order of one million to a few billion solar masses inhabiting the centers of massive, bulge-dominated galaxies in the local universe. These SMBH masses correlate strongly with the mass of the host galaxy's bulge. SMBHs, with masses up to 10 billion solar masses, have also been discovered at very high redshift, and thus existed in the early universe. How could such SMBHs have existed so early in the universe? One key component in understanding the origin and rapid growth of SMBHs lies in studying smaller SMBHs which inhabit smaller galaxies. However, few of these medium-sized SMBHs have been found, and detection capabilities are currently limited. This is a significant deficiency since the study of this population allows us to gain insight into the origin and growth efficiency of SMBH seeds, thought to have formed at high redshift, and allow us to finally determine how SMBHs form. Most studies aimed at finding SMBHs have been conducted using optical spectroscopic studies, where active SMBHs (active galactic nuclei or AGNs) display distinctive optical emission lines indicative of accreting SMBHs. As the black hole mass decreases, the Schwartzchild radius of the black hole decreases, and in response, the temperature of the surrounding accretion disk increases. The shape of the ionizing radiation field therefore changes with black hole mass, potentially affecting the optical spectroscopic signatures generally associated with AGNs. In this work, we investigate the effect of black hole mass on the emission line spectrum from AGNs in order to predict the spectroscopic features of medium-sized SMBHs. The predictions from these studies will inform future searches for low mass black holes by the upcoming James Webb Space Telescope, scheduled for launch in fall of 2018.

39: Reactions of Nitrogen Atoms with Acetylene in Argon Matrices

Savanna Castello, Paul Cooper
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Pluto's red color is an indication of the presence of tholins, which are complex organic molecules. They are formed by the irradiation of small organic molecules, such as methane and acetylene, in nitrogen rich environments. Since, Earth's primitive oceans contained tholins, it is believed that they are relevant to the origin of life. Using a matrix isolation technique at 6K, mixtures of acetylene, argon, and nitrogen gases were rapidly condensed into matrices and analyzed using infrared and mass spectroscopy. The measured absorption bands were consistent with the formation of the C2H, C4H3, and N3 radicals. The formation of these radicals were confirmed by comparing the experimental absorption bands to literature values. Understanding the formation and interaction of these radicals will help in understanding the formation of Pluto's tholins.

40: An Empirical Investigation of the Deep Structure of Human Knowledge: Causal Relationships and the "Language of Thought"

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Artificial intelligence (AI) systems profit by drawing inspiration from conventional human intelligence. One popular hypothesis advanced by Jerry Fodor asserts there is a fundamental “Language of Thought” (LOT) by which any cause and effect relationship is understood. Since cause and effect relationships underpin reasoning, and reasoning is a paradigmatic component of human intelligence, AI systems can be enhanced by more accurate depictions of causal reasoning, and the use of causal relationships as a knowledge representation mechanism. Causal relationships and reasoning seem to play central roles in intelligent behavior, and also, we believe, in the “deep structure” of the LOT. Our research objective is to obtain a clearer picture of how causal relationships and human knowledge are represented in this deep structure, independent of language. We compiled sentence structure data for one type of causal relationship, across multiple languages from the Indo-European language tree. We then examined the various components of these causal relationships, on a per-language basis, to gain insight into the commonalities that exist in causal relationships among the languages. Results indicate that while the syntactic structure of causal relationships of sentences may vary from language to language, the causal relationship itself (and the information conveyed by that relationship) remains constant across languages. This finding demonstrates that "deep structure" of causal relationships may be language independent, and thus, represent a fragment of the LOT. These initial findings also support Chomsky’s “Universal Grammar” hypothesis. Further study is planned to explore the seeming fundamental role played by causal relationships in human intelligence and reasoning.

41: Synthesis and Characterization of Core-shell Hydrogel Particles Containing Cibacron Blue F3G-A

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Cationic antimicrobial peptides (CAMPs) are an important class of biomolecules known to kill or inhibit the growth of microorganisms, while causing little to no damage to the host. However, they are usually present at very low concentration in all living species, thus their isolation and identification presents significant difficulties using conventional proteomic separation techniques. New core-shell hydrogel particles consisting of an inert core within a harvesting shell have been developed to tackle this problem. The hydrophobic core facilitates particle recovery during the harvest process, while the outer shell contains Cibacron blue F3G-A (CB), a widely used triazinyl dye known to interact with proteins. The CB affinity baits, together with the â€œgreasyâ€ polymer network in the shell, are expected to lend the core-shell hydrogel particles excellent performance in harvesting a broad spectrum of low-abundance proteins/peptides from complex biological samples. Herein, we synthesized an amphipathic monomer, N-methacryloyl-6-aminohexanol (MA6AHOH), which combined long-chain aliphatic hydrocarbons and hydroxyl functionalities. Using this monomer, we generated core-shell particles using reversible addition-fragmentation chain transfer (RAFT) polymerization from previously synthesized inert core particles. Cross-linker methylenebisacrylamide (BIS) was also used in forming the shell so the mesh size of the polymer network was controlled to exclude unwanted high molecular weight moieties. CB was then introduced into the particles by reacting with the hydroxyl groups in the outer layer. Following that, the CB-loaded particles were tested in comparison with the precursor to evaluate their protein uptake and molecular sieving properties by conducting SDS gel electrophoresis.

42: Investigating Learning Assistant Oral Review Strategies on Student Learning in Biology Courses at George Mason University

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We have begun an over-arching investigation to examine the impact that orals will have on student achievement in biology courses, and we are integrating this strategy with the Mason Student Success Collaborative (SSC). At this stage, we have engaged the Biology Faculty to identify students who have performed less than 70% on their first exam, because initial results show that students in the approximate "D-range" who attend orals increase their grade to C or better. Hence, we are conducting a two-pronged investigation, wherein we will interview students of the target group, the LAs who are teaching orals, and to understand how recruitment tactics can target students to attend the orals review sessions. Aims of this investigation are to: 1) Examine if an how attendance at orals correlates to exam grades throughout the semester, 2) Determine how an oral review session(s) help students improve their performance, and 3) Generate and evaluate the interview and grade performance to understand characteristics of students and orals teaching strategies that are effective. At this hour, we have enlisted the SSC to target students for orals sessions, and we are working with professors to email students who performed less than the target level. In this poster, we present the overall strategy, with the intention of engaging LAs and faculty members to participate and overall raise student achievement in STEM.

43: Investigating Different Learning Styles in Anatomy and Physiology Classes

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In any education setting it is important to understand the variety of ways an individual can learn to best accommodate to their educational needs. One common model used is the Visual, Auditory and Kinesthetic, or VAK model. In undergraduate anatomy and physiology courses at George Mason University students are provided with a learning assistant (LA)who hold review sessions for each exam. For this investigation, LA review sessions were held for each of the four exams in the class. The first three review sessions had a specific focus, either visual, auditory or kinesthetic. The final review sessions were held in a multimodal fashion, incorporating all three aspects. Exam scores were collected after each exam for individuals who attended the review sessions. At the end of the semester students will be asked to complete a VAK identifier questionnaire, and the results will then be compared with exam scores. The purpose of this study is to identify if there is a specific learning style in which students perform best in Anatomy and Physiology courses, and to see if individual VAK test results align with higher performing exam scores if review sessions were taught in that preferred modality. At the time of this presentation, results from two exams and the corresponding review session attendance will have been analyzed.

44: Next-Generation Sequencing

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Next-generation sequencing, also known as NGS, has fundamentally changed the scientific world. NGS allows the DNA and RNA of specific organisms or samples of organisms to be analyzed quickly, and in larger quantities. Unfortunately NGS strategies can be sophisticated: instructional strategies need clear explanations about how NGS technologies work, and should allow NGS strategies to be much more easily understood by students and bioscientists. Therefore I am working with a number of students, professors, and graduate students to craft innovative educational videos that explain NGS approaches that are relevant for investigating microbial populations. In these videos, I introduce NGS and explain computational software (such as Geneious) to visual and analyze genetic sequences. These videos explain how samples can be analyzed to identify what organisms are in the sample, by identifying (barcoding) the 16s RNA sequences within each sample. I am mid-production of five educational videos, which will be used in biology courses at Mason. The five videos of NGS will be as follows: Introduction to NGS, Pipeline Method, Barcoding, QIIME (a pipeline that stands for Quantitative Insights Into Microbial Ecology), and QIIME outputs. These videos are being designed to help students understand the NGS process and develop their bioinformatics knowledge and skills. We will investigate how useful these videos are in a summer course that teaches about microbial ecology, and we hope these productions will help scientists best use NGS in their research. At this multi-media poster presentation, I will showcase two of the videos that have been developed.

45: Assessing STEM Boot Camp Participation and Academic Performance: A Longitudinal Analysis of Two STEM Boot Camp Cohorts (2013 and 2014)

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Studies have shown that all students, regardless of major, have difficulties during their first semester of college. Studies have also shown those students who declare one of the STEM majors have the most difficulty. The College of Science's STEM Accelerator Program offers one-week long intensive summer camp to prepare incoming STEM majors for the rigor of college-level STEM courses, with a specific focus on introductory courses in biology (Cell Biology), chemistry (General Chemistry) and math (Calculus). Thus students are given the opportunity to explore their field in more detail and experience a realistic example of college life. The College of Science's STEM Accelerator Program hopes to foster students' curiosity and enthusiasm for their STEM major.The STEM Boot Camp is a modified version of BIOS (Biology Intensive Orientation for Students) held at Louisiana State University (LSU). Since LSU's BIOS Boot Camp demonstrated successful results, STEM Accelerator faculty implemented a similar camp for incoming freshmen STEM majors. The camp is designed for students who have declared biology, forensic science, geology, environmental science, chemistry, math, engineering or physics as their major. The ultimate goal of this longitudinal research is to determine if STEM Boot Camp participation: (1) positively correlates with a student's decision to continue as STEM major; (2) results in Camp attendees graduating with a STEM degree; (3) results in a student graduating within 4 years. We present qualitative and quantitative data from STEM majors who participated in Boot Camps held in July 2013 and July 2014.

46: Comparison of Exams for Active Learning Technologies vs. Traditional Lectures

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George Mason University has first semester (PHYS-160) and second semester (PHYS-260) physics courses which consist of two sections. One is a traditional lecture style format (TRAD) and the other is a newer format which is a take on the "flipped" classroom. This newer style is referred to as Active Learning with Technologies (ALT). This course style has been in place for several years and has been studied before within George Mason University for final grade differences. These studies suggested that the ALT sections performed better, but grade weighting consistency, test time, and test content were not strictly controlled. The purpose of this study is to cross-examine the performance of students in these different class formats during Fall 2016 (PHYS-260) and Spring 2015 (PHYS-160) on very nearly identical exams over identical test times while controlling for almost every variable.

47: Application of Hydrogel Nanoparticles for a Rapid Latent Tuberculosis Diagnostic Test

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According to the World Health Organization (WHO), there is an urgent need for a highly sensitive, rapid point of care diagnostic test for active TB and LTBI. The diagnostic tests available to people where TB is a leading cause of death are indirect (quantification of immunological response), invasive (requiring blood sample or an injection), time consuming (24+ hours) and expensive. TB biomarkers demonstrate low concentrations in urine, and currently available urinary assays are neither sensitive nor rapid enough. We are developing an electrical, paper-based immunoassay using high affinity capture hydrogel nanoparticles and amperometric sensors to provide a sensitive, specific, and quantitative method for LTBI diagnostics from urine samples. The hydrogel nanoparticles employed are an open mesh network of polymers with high affinity chemical baits dyed to their surface. They exhibit strong protein degradation protection and amplification of target biomarker. Incorporating copper dyes on their surface enables their presence to be detected electrically. By coupling an Arduino Pro Mini microcontroller board with a voltage divider circuit and amperometric sensors, we have demonstrated that copper dyed nanoparticles included with enzymatic reagents, horseradish peroxidase, glucose, and glucose oxidase, can be reliably detected by monitoring the current response of the hydrogel nanoparticles. The capability of measuring the nanoparticles presence allows us to create an electrical paper-based device that can quantitatively detect the presence of TB biomarkers.

48. Consequences of Early Parental Influence on Future Parenting Behaviors in Cockatiels (*Nymphicus Hollandicus*)

Lauren Rosario, Doris Davis
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I studied the influence of hand rearing on adult parenting behaviors in *Nymphicus hollandicus* first time parents. Previous studies varied in their definition of "hand reared," as well as duration. The study was conducted over a month and a half time period and included two clutches (n=9). The success rate was 66%. The hand reared female performed poorly in most measures compared to the parent raised male. She performed worst in dietary variety, causing the second clutch to have calcium deficiency. The female performed better in only two measures; weaning and defense. The male performed well in all measures except defense. The effect of hand raising is similar to isolation, causing poor parental strategies and reducing reproductive success. The first six weeks of parental modeling are critical for successful clutch creation and maintenance.