

# UNDERGRADUATE RESEARCH Highlights

Burgado J, Harrell CS, Eacret D, Reddy R, Barnum CJ, Tansey MG, Miller AH, Wang H, Neigh GN. Two Weeks of Predatory Stress Induces Anxiety-like Behavior with Co-morbid Depressive-like Behavior in Adult Male Mice. *Behavioural Brain Research*. 2014; 275: 120-125. (Emory University)

Psychological stress has been implicated in the onset and severity of mental illnesses such as anxiety and depression. In this study, we modeled chronic psychological stress using a novel predatory-stress paradigm that takes advantage of the natural predator/prey relationship between rats and mice. Mice were exposed to the sight and smells of their natural predators in a controlled laboratory environment. Our results demonstrate that two weeks of predatory stress in adult male mice elicits anxiety-like and depressive-like behaviors, with a concomitant improvement in recognition memory. Gretchen Neigh is an assistant professor in the Department of Physiology. Jillybeth Burgado completed this work as a fellow in the NET/work program during the summer prior to her junior year and is currently a senior. As volunteers, Renuka Reddy and Darrell Eacret both participated in this research during the summer before their senior years. Both Reddy and Eacret are now employed with plans to eventually enter, respectively, medical and graduate school. This work was supported by NASA, the National Institutes of Health NIH R25, and Graduate and Postdoctoral Training in Toxicology grants.

Ledley FD, McNamee LM, Uzdil V, Morgan IW. Why Commercialization of Gene Therapy Stalled; Examining the Life Cycles of Gene Therapy Technologies. *Gene Therapy*. 2014; 21:2: 188-194. (Bentley University)

This report examines the commercialization of gene therapy in the context of innovation theories that posit a relationship between the maturation of a technology through its life cycle and prospects for successful product development. An analytical model of technology maturation shows that gene-therapy technologies have matured steadily since the 1980s. This maturation, however, has been negatively correlated with capital investments in gene-therapy companies and clinical investigations of potential commercial products. This asynchrony between the maturation of gene-therapy technologies and the business models for product development may have stalled the commercialization of gene therapy. Fred Ledley is director of the Center for Integration of Science and Industry and a professor in the Departments of Natural & Applied Sciences and Management. Vedat Uzdil was an undergraduate researcher in the Center for

Integration of Science and Industry and currently is a consultant with Ernst & Young in Istanbul, Turkey. This work was supported by a grant from the National Biomedical Research Foundation and the Jeanne and Dan Valente Center at Bentley University.

Oprisan SA, Dix S, Buhusi CV. Phase Resetting and its Implications for Interval Timing with Intruders. *Behavioral Processes*. 2014; 111: 146-153. (College of Charleston)

We used a computational model of a distributed neural network of the strato-cortical structures of the brain in order to mimic the perception of time. The computational model gave similar results with experiments conducted in mice. In particular, in this study we investigate the effect of emotional stressors on the subjective perception of time. We carried out both numerical simulations with our newly developed computational model and experiments to validate our results. Sorinel A. Oprisan is an associate professor interested in research in computational neuroscience. Steven Dix is a software engineer currently working for Google. As an undergraduate researcher in this project, he optimized the computational implementation and carried out extensive numerical simulations to verify the effect of external stimuli on the ability of the neural network to perform correct timing. A National Science Foundation Career grant IOS-1054914 to Oprisan supported this research on phase resetting.

Armstrong EL, Bryan CJ, Stephenson JA, Bryan AO, Morrow CE. Warzone Stressor Exposure, Unit Cohesion, and Emotional Distress among U.S. Air Force Pararescuemen. *Journal of Special Operations Medicine*. 2014; 14: 26-34. (University of Utah)

Combat exposure is associated with increased severity of mental health symptoms among military personnel, whereas unit support is associated with decreased severity. However, to date no studies have examined these relationships among U.S. Air Force pararescuemen, a unique and specialized career field in which such personnel serve in both medical and combat capacities. The results of this study indicated that medical-related stressors contribute more to post-traumatic stress disorder (PTSD) among pararescuemen than do traditional combat-related stressors, and that unit support is associated with reduced PTSD and reduced severity of depression regardless of the intensity of warzone exposure among pararescuemen. Craig J. Bryan is an assistant professor of psychology. Erica Armstrong is currently a senior in the department of psychology and has

been a research volunteer since the 2011-12 academic year. She worked on this published study with funding received from the Undergraduate Research Opportunities Program. The research was supported by the Department of the Air Force.

**Pauers, MJ, McMillan, SA.** Geometric Morphometrics Reveals Surprising Diversity in the Lake Malawi Cichlid Genus *Labeotropheus*. *Hydrobiologia*. 2014; DOI: 10.1007/s10750-014-1941-2. (Milwaukee Public Museum and the University of Wisconsin-Waukesha).

The Lake Malawi cichlid genus *Labeotropheus* (fish) contains two species, *L. fuelleborni* and *L. trewavasae*. Using a geometric morphometric analysis of 18 populations of *Labeotropheus*, we show that body shape varies distinctly among populations both within and between species. Our results suggest that the current morphological criteria applied to the *Labeotropheus* are not accurate and hamper the recognition of *Labeotropheus* biodiversity. Michael J. Pauers is the adjunct curator of fishes, the Orth Family Ichthyology Research Fellow at the Milwaukee Public Museum, and assistant professor of zoology at UW-Waukesha. Scott A. McMillan is a returning adult student who completed his associate's degree in arts and sciences in 2012 at UW-Waukesha and is currently applying to bachelor's-degree programs in ecology and conservation. McMillan participated in this project to earn independent study credits. This project was funded in part by the Orth Family Ichthyology Research Endowment at the Milwaukee Public Museum.

**Hu N, Straub CM, Garzarelli AA, Sabey KH, Yockman JW, Bull DA.** Ligation of the Left Circumflex Coronary Artery with Subsequent MRI and Histopathology in Rabbits. *Journal of the American Association for Laboratory Animal Science*. 2010; 49: 838-844. (University of Utah)

Atherosclerotic plaque in the coronary artery causes narrowing of its lumen, resulting in failure to supply adequate oxygen and nutrients to the heart. This limitation accounts for the clinical manifestations of myocardial infarction. To understand the structure/function relationship in the postinfarcted myocardium in rabbits, we induced cardiac ischemia by ligating the left circumflex coronary artery. We studied the distinct myocardial segments of the left ventricle to understand the 3D depiction of the myocardial macrostructure and to gain insights into the structure/function relationships in the myocardium following myocardial infarction. Norman Hu is research associate professor in the Department of Pediatrics at the University of Utah School of Medicine. Kyle H. Sabey was a recipient of the Undergraduate Research Opportunities Program (UROP) award from the University of Utah. He wrote an honors thesis, and his work was selected for

presentation at the Posters on the Hill event at the Utah state legislature. He is currently an osteopathic medical student. The research was supported by the Department of Pediatrics and the Undergraduate Research Opportunities Program at the University of Utah.

**Yu J, Butler IS.** Recent Applications of Infrared and Raman Spectroscopy in Art Forensics: A Brief Overview. *Applied Spectroscopy Reviews*. 2015; 50:2: 152-157. (McGill University)

A brief overview of the recent applications of infrared and Raman spectroscopy in the field of art forensics was presented. This short review described some applications of the typical molecular spectroscopy instrumentation that is now available to museum personnel. This is significant as vibrational spectroscopy will continue to gain importance in the examination of artworks and other cultural heritage items. Ian Butler is professor of chemistry at McGill University; Joanne Yu is a chemistry undergraduate at the University of Windsor, and a participant in Windsor's Outstanding Scholars program. Yu participated in the research during the summer of 2014. The research was supported by the Inorganic Division of the Canadian Society for Chemistry, and Yu obtained an Inorganic Chemistry Exchange scholarship.

**Andrade T, Kang HH, Cooper K.** A Korean Military Revolution?: Parallel Military Innovations in East Asia and Europe. *Journal of World History*. 2014; 25:1: 51-84. (Emory University)

This article argues that advances in drilling techniques and the use of muskets—essential ingredients of the Military Revolution model—were central to Korean military reforms following the Imjin War of 1592-1598. Using military manuals from the seventeenth century, we show that European drilling regimes—centered around musketry units—had striking analogues in Korea. Similarities in such far-removed societies make clear that there is a need for a truly global military history. Tonio Andrade is professor of history. Hyeok Hweon Kang began this research as a fellow in the Scholarly Inquiry and Research at Emory (SIRE) Research Partners Program. He continued working on this project as an undergraduate fellow of the Fox Center for Humanistic Inquiry at Emory University and wrote an honor's thesis with Andrade in Emory's history department. Kang is now a PhD candidate at Harvard University in the East Asian Languages and Civilizations Program. Kirsten Cooper also began working with Andrade as part of the SIRE Research Partners Program and wrote a history honor's thesis. She is now a PhD candidate at the University of North Carolina, Chapel Hill.

**Perreau, A, Tatge, BR.** A Comparison of Listening Effort in Individuals with Cochlear Implants and Normal Hearing. November 4, 2014, Augustana College, Rock Island, IL. (Augustana College)

The present study examined how listening effort affects individuals with hearing loss who use cochlear implants (CIs) compared to individuals who have normal hearing. A dual-task paradigm was used to measure listening effort, which consisted of a primary auditory task measuring speech perception, and a secondary visual task to assess reaction time measured in msec. The tasks uncovered significant differences between the CI users and participants with normal hearing for both the speech-perception scores and the visual-task reaction times, showing higher levels of listening effort in CI users. Ann Perreau is an assistant professor of communication sciences and disorders. Bailey Tatge, a senior majoring in communication sciences and disorders and psychology, participated in the research during the summer of 2014 for credit for her senior inquiry thesis. She remains enrolled at Augustana College and is applying to graduate programs in audiology. The New Faculty Research Award supported this research.

**Chen S, Mason ND, Cooper SC, Miller A.** A Projection of Economic Impact and Benefits of a Proposed Tail System. *KAHPERD Journal*. 2014; 51:2: 58-71. (Morehead State University)

The purpose of this feasibility study was to justify the rationales for using public funds to construct the Dewey Lake Trail System (DLTS) in Floyd County, Kentucky. According to responses of 119 visitors to a local festival, the majority (92 percent) of the respondents favored the idea of building the trail system. Results also suggested the trail project might generate an annual economic impact of \$1.7 million for Floyd County through attracting individuals to engage in fishing, walking/hiking, camping, horseback riding, and cultural festivals and events. The building of the DLTS would be an ideal, feasible, and profitable endeavor to pursue, according to the study. Steven Chen is an associate professor of sport management. Nicholas Mason is a senior sport-management major who participated in the study as an Undergraduate Research Fellow. Mason is currently a substitute teacher at a middle school in Ohio. The project was supported by the Office of the Center for Regional Engagement of Morehead State University.

**Putnam RA, Mohaidat QI, Daabous A, Rehse SJ.** A Comparison of Multivariate Analysis Techniques and Variable Selection Strategies in a Laser-induced Breakdown Classification. *Spectrochimica Acta B*. 2013; 87 161-167. (University of Windsor)

Laser-induced breakdown spectroscopy was used to obtain spectral fingerprints from live bacterial specimens from thirteen distinct taxonomic bacterial classes representative of five bacterial genera. By taking sums, ratios, and complex ratios of measured atomic emission line intensities, three unique sets of independent variables (models) were constructed to determine which choice of independent variables provided optimal genus-level classification of unknown specimens, utilizing a discriminant-function analysis. Steven Rehse is associate professor of physics at the University of Windsor. Qassem Mohaidat was a graduate student at Wayne State University when this research was completed. Russell Putnam and Andrew Daabous were undergraduates in the Outstanding Scholars Program at the University of Windsor. Putnam is now a candidate for a master's degree in physics at the University of Windsor. Daabous is in his senior year there. The Outstanding Scholars Program funded the work of the undergraduates.

**Wang T, Zhao D, Guo X, Riehl B, Heineman WR.** Carbon Nanotube-Loaded Nafion Film Electrochemical Sensor for Metal Ions: Europium. *Analytical Chemistry*. 2014; 86: 4354-4361. (University of Cincinnati)

A MWCNT-Nafion modified GC carbon electrode was developed for sensitive detection of Eu<sup>3+</sup>. Electrochemical impedance spectroscopy, cyclic voltammetry and preconcentration voltammetry were applied to study the MWCNT concentration-dependent electrochemical behavior of the modified electrode. William Heineman is a professor of chemistry. Jaime joined the Research Experiences for Undergraduates program at Cincinnati and worked on this project from June until August 2014. He is currently working for a chemical company in Houston. This work is supported by National Science Foundation's Engineering Research Centers (NSF-ERC). Jaime was supported by an NSF-Research Experiences for Undergraduates grant last summer.

**Connor NC, Sarraino S, Frantz D, Bushaw-Newton K, MacAvoy SE.** Geochemical Characteristics of an Urban River: Influences of an Anthropogenic Landscape. *Applied Geochemistry*. 2014; 47: 209-216. (American University)

In this project we examined approximately two years of aqueous geochemical and nutrient data in order to identify urban influences on river chemistry along a gradient from suburban to urban in the Anacostia River in Washington, D.C. The objectives were to (1) use relationships among geochemical components and concentrations of Ca, Mg, K and Na to assess urban influences, and (2) determine concentrations of nutrients (NO<sub>3</sub><sup>-</sup>, NH<sub>4</sub><sup>+</sup>, PO<sub>4</sub><sup>3-</sup>) in this anthropogenically influenced river in the United States' capital. Stephen MacAvoy is an assistant professor of environmental science. Deborah Frantz worked on this in 2010 as an independent study project and is currently employed with the U.S. Geological Survey.