

UNDERGRADUATE RESEARCH Highlights

Williams LM, Lago BA, McArthur AG, Raphenya AR, Pray N, Saleem N, Salas S, Paulson K, Mangar RS, Liu Y, Vo AH, Shavit JA.

The Transcription Factor, Nuclear Factor, erythroid 2 (Nfe2), Is a Regulator of the Oxidative Stress Response during Danio rerio Development. *Aquatic Toxicology*. 2016; 180: 141–154. (Bates College, McMaster University, and the University of Michigan)

This study investigated the importance of a transcription factor, Nfe2, in the response to oxidative stress in zebrafish at the phenotypic and transcriptomic level during development. Animals were treated with pro-oxidants at three stages during development. Early in development, Nfe2 knockout animals suffered from hypochromia that was made more severe through exposure to pro-oxidants; this phenotype may be linked to decreased expression of *alas2*, a gene involved in heme synthesis. Across time and treatment, there were six genes that were significantly up-regulated in the knockout compared to wildtype and four genes that were significantly down-regulated. These results demonstrate that the zebrafish Nfe2 may be a regulator of both primitive erythropoiesis and the oxidative stress response during development. Larissa Williams is an assistant professor of biology at Bates College. Andrew McArthur is an associate professor in the Department of Biochemistry and Biomedical Sciences as well as Cisco Chair in Bioinformatics at McMaster University. Jordan Shavit is an assistant professor in the Department of Pediatrics and Communicable Diseases at University of Michigan. During 2015–2016 Briony Lago, a McMaster University undergraduate, worked on this project as a co-op student and summer fellow. In 2014–2015 Nicholas Pray worked on the project as part of his senior thesis and is a dental student at the University of Connecticut. During summer 2014 and the 2014–2015 academic year, Sophia Salas and Nabil Saleem worked on this project as fellows and senior thesis students. Salas is a research assistant at Brigham and Women's Hospital, and Saleem is a medical student at Tufts. Katherine Paulson and Roshni Mangar worked on the project during their 2014 summer fellowships. Paulson is a fellow at the Institute for Health Metrics and Evaluation, and Mangar is an employee at the Bar Harbor Whale Watch Company. This research was supported by NIH grants P20GM103423 and R01HL124232, MDIBL (USAMRMC W81XWH-11-1-0425), Bodi Schmidt-Nielsen Fund, McMaster Research Fund, a M.G. DeGroot Summer Fellowship, and the Canadian Foundation for Innovation. 

Raines DA, Barlow K, Manquen D, Povinelli T, Wagner A. Evaluation of an Evidence-Based Teaching Program for New-

born Safe Sleep. *Neonatal Network: The Journal of Neonatal Nursing*. 2016; 35:6:397–400. (University at Buffalo and Sisters of Charity Hospital)

This research evaluated the effectiveness of an evidence-based teaching guideline and patient outcomes focused on newborn safe sleep. This was a descriptive study with two data collection points. A convenience sample of 48 new mothers completed both data collection points. The findings of this evaluation study demonstrate that this unit-based teaching program was effective in impacting mothers' knowledge about and practice of safe sleep for the newborn following discharge from the postpartum unit. Deborah A. Raines is an associate professor of nursing and a research mentor for the summer N.U.R.S.E. program. Donna Manquen, Theresa Povinelli, and Ashley Wagner are registered nurses in the Mother-Baby Unit at Sisters of Charity Hospital. Khloe Barlow is a BSN student, class of 2017, in the School of Nursing at the University at Buffalo. Barlow initiated work on this research as a participant in the summer N.U.R.S.E program in 2015. 

De La Rosa-Acosta M, Jimenez-Collazo J, Maldonado-Roman M, Malave-Llamas K, Musa-Wasil JC. Bacteria as Potential Indicators of Heavy Metal Contamination in a Tropical Mangrove and the Implications on Environmental and Human Health. *Journal of Tropical Life Science*. 2015; 5:3: 110–116. (Universidad del Este, Carolina, Puerto Rico)

The study examined the sensitive nature of some bacteria to heavy metals and their potential as bioindicators. The objective of this research was to assess the bacterial community on a mangrove marsh, identify these bacteria, and correlate bacterial species with the type and concentration of the metals found on the site. Karlo Malave-Llamas is an assistant professor in the School of Science and Technology at Universidad del Este, and Juan Musa-Wasil is a professor in the School of Environmental Affairs at Universidad Metropolitana (UMET). Melanie De La Rosa-Acosta was an undergraduate student at the beginning of the project (summer 2014) sponsored by NIH-MBRS-RISE at Universidad del Este (UNE). She is pursuing her master's degree in environmental planning at AGM Online. Johannys Jimenez-Collazo was an undergraduate student at the beginning of the project (summer 2014) at UNE; she embarked on this endeavor as an independent volunteer student. She is pursuing a master's degree in environmental planning in the School of Environmental Affairs (SEA) at UMET. Marixa Maldonado-Roman was a graduate student at the beginning of the project (summer 2014) at SEA-UMET; she embarked on this endeavor as an indepen-

dent volunteer student. She graduated and is considering doctorate-level study. This research was supported by Universidad del Este Institutional Funds and a NIH-MBRS-RISE Grant. 

Bou-Abdallah F, Sprague SE, Smith BM, Giffune TR. Binding Thermodynamics of Diclofenac and Naproxen with Human and Bovine Serum Albumins: A Calorimetric and Spectroscopic Study. *The Journal of Chemical Thermodynamics*. 2016; 103: 299–309. (State University of New York at Potsdam)

Serum albumins are ubiquitous proteins able to bind a variety of exogenous and endogenous ligands including hydrophobic pharmaceuticals. Drug binding to serum albumin provides important pharmacological information and influences drug solubility, efficacy, biological distribution, and excretion. Here, the binding thermodynamics of two non-steroidal anti-inflammatory drugs (Diclofenac and Naproxen) to bovine and human serum albumins were studied by isothermal titration calorimetry, fluorescence spectroscopy, and differential scanning calorimetry. The calorimetric and spectroscopic data presented herein provided insights into the nature of these protein-drugs interactions. Such studies might offer useful information in future drug discovery studies. Fadi Bou-Abdallah is an associate professor of chemistry at SUNY Potsdam. Sam Sprague graduated from SUNY Potsdam in 2015 and is enrolled in the 3/2 chemistry engineering program at Clarkson University, Britannia Smith is a senior at SUNY Potsdam completing her BS degree in biology, and Thomas Giffune is a triple-major graduate (biology, chemistry, and physics) from SUNY Potsdam and has been offered a position at the Combat Systems Safety Branch at Naval Surface Warfare Center, Dahlgren Division, VA. Sprague, Smith, and Giffune all worked on the project in 2015 for research credits. This work was supported by NSF (NSF MRI Award no. 0921364 to Bou-Abdallah) and by the Cottrell College Science Award (ID no. 7892) from Research Corporation (to Bou-Abdallah). 

Mishra B, Fragile PC, Johnson LC, Kluźniak W. Three-dimensional, Global, Radiative GRMHD Simulations of a Thermally Unstable Disc. *Monthly Notices of the Royal Astronomical Society*. 2016; 463:4: 3437–3448. (College of Charleston)

We present results of a set of three-dimensional, general relativistic radiation magnetohydrodynamics simulations of thin accretion discs around a nonrotating black hole to test their thermal stability. We consider two cases, one that is initially radiation-pressure dominated and expected to be thermally unstable, and another that is initially gas-pressure dominated and expected to remain stable. We find evidence for both thermal and viscous instabilities in our radiation-pressure-

dominated case. Bhupendra Mishra is a PhD student and Włodzimierz Kluźniak is a professor at the Nicolaus Copernicus Astronomical Center in Warsaw. P. Chris Fragile is a professor of physics and astronomy at the College of Charleston. Caroline Johnson was a junior physics major at the College of Charleston when she contributed to this work as part of a summer project. This research was also supported by the National Science Foundation under grant NSF AST-1211230. 

Meusel C, Grimm C, Gilbert S, Leucke G. An Agricultural Harvest Knowledge Survey to Distinguish Types of Expertise. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*. 2016; 60:1: 2048–2052. (Iowa State University)

This work describes an agricultural harvest knowledge survey that was created for user research studies that observed experienced combine operators driving a combine simulator in virtual crop fields. Based on the success of this survey as a population segmentation tool, the authors recommend three criteria for the design of future knowledge surveys in other domains: (1) use real-world scenarios, (2) ensure questions are neither too difficult nor too easy, and (3) ask the minimum number of questions to identify operator knowledge successfully. Future research aims to create a tool that can discern between system experts (with deep understanding of the system) and practice experts (who primarily have the wisdom of experience). Stephen Gilbert is an assistant professor of industrial engineering and Greg Leucke is an associate professor in mechanical engineering at Iowa State University. Chase Meusel is currently a PhD student in human computer interaction (HCI) at Iowa State University. Chase Grimm is a third-year undergraduate in industrial engineering at Iowa State University. The research was funded by John Deere. 

Volz, K, Yang E, Dudley R, Lynch E, Dropps M, Dorneich MC. An Evaluation of Cognitive Skill Degradation in Information Automation. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*. 2016; 60:1: 191–195 (Iowa State University)

The purpose of this research is to investigate long-term effects of cognitive skill degradation (CSD) through the use of automation. Measurement and analysis of the effects of Information Automation (IA) on cognitive performance is an important first step in understanding CSD, which should be considered during design of these systems. The use of an automation aid was expected to result in a high level of performance degradation over time. Participants were placed into three groups and asked to perform flight planning calculations; the results of this study show that the use of an automation aid presented the highest level of performance degradation. This work provides the foundation for design

of guidelines/recommendations for IA systems in order to prevent CSD. Michael C. Dorneich is an associate professor in industrial and manufacturing systems engineering at Iowa State. Katherine Volz is a concurrent MS student at Iowa State and worked on this research from fall 2013 to spring 2016. Euijung Yang graduated from Iowa State with her PhD and is currently employed. She worked on this project from spring 2014 to spring 2016. Rachel Dudley graduated from Iowa State with her MS and is currently employed. She worked on this project during fall 2013. Elizabeth Lynch is a senior at Iowa State and worked on this project during spring 2014. Maria Dropps graduated from Iowa State with her BS and is currently employed. She worked on this project during spring 2015. This work was funded by the Industrial and Manufacturing Systems Department's Undergraduate Research Assistant program. 

Guerra I, Schroeder SJ. Crumple: An Efficient Tool to Explore Thoroughly the RNA Folding Landscape. *Methods Mol. Biol.* 2016; 1490: 1–14. (University of Oklahoma)

This paper presents a practical user guide for Crumple, a program that computes a combinatorially complete set of non-pseudoknotted RNA structures for an input RNA sequence. The program output provides a foundation for hypothesis-driven research on viral RNA structure and function. The program is unique in its ability to incorporate experimental constraints from cryoelectron microscopy, crystallography, and in vitro evolution data. The development of Crumple has been a long-term ongoing undergraduate programming project in the Schroeder lab. A team of undergraduate programmers continues to work with the Oklahoma Supercomputing Center for Education and Research to parallelize the next-generation software for these RNA folding computations. Susan Schroeder is an associate professor in the Departments of Chemistry and Biochemistry, and Microbiology and Plant Biology. Ivan Guerra is a senior computer science major and received the Hypercube Award in the Department of Chemistry and Biochemistry in recognition of his outstanding research contributions. Guerra continues to conduct research through an internship program with Northrup Grumman and plans to graduate in spring 2017. Guerra's sophomore research project was supported by the Louis Stokes Alliance for Minority Participation in Oklahoma. An NSFCAREER award also supported this undergraduate project. 

Nika L, Gibson T, Konkus R, Karp X. Fluorescent Beads Are a Versatile Tool for Staging *Caenorhabditis elegans* in Different Life Histories. *G3*. 2016; 6:7: 1923–1933. (Central Michigan University)

Caenorhabditis elegans is a model organism, the study of which

has revealed fundamental biological principles relevant to human health. This study describes a novel method to aid in identifying different stages of *C. elegans*. Such identification is critical to their study. This new method overcomes some of the limitations of previous methods. Xantha Karp is an assistant professor of biology at Central Michigan University. Liberta Nika began this work as an undergraduate student and finished it as a master's student. Nika is currently finishing her MS and applying to PhD programs. Taylor Gibson and Rebecca Konkus were undergraduate researchers throughout the project. Gibson is now in physical therapy school, and Konkus took a job in a health-related field upon graduation. This work was supported by a combination of funding from Central Michigan University (start-up funds, and grant C62241), and from the NIH (R15 GM117568) 

Al Kazimi A, MacKenzie C. The Economic Costs of Natural Disasters, Terrorist Attacks, and Other Calamities: An Analysis of Economic Models that Quantify the Losses Caused by Disruptions. *Systems and Information Engineering Design Symposium, University of Virginia.* 2016; 1: 32–37. (Iowa State University)

Over the past decade, numerous studies have estimated the economic impacts of a variety of disruptions. This paper compiles the results from economic models in order to compare the costs of different disruptions and help decision makers prioritize among disruptions. We compare the direct and indirect economic losses from a variety of disruptions, including earthquakes, hurricanes, terrorist attacks, pandemic diseases, and port closures. Some studies model hypothetical scenarios, but other studies quantify the economic losses from historical events such as the September 11 attacks and the 2011 Japanese tsunami. This paper provides a useful benchmark to understand the consequences from disruptions and highlight areas that public officials could address in planning for future disruptions. Cameron MacKenzie is an assistant professor in industrial and manufacturing systems engineering at Iowa State University. Amro Al Kazimi is a senior in industrial and manufacturing systems engineering at Iowa State University. Funding of this project was through the IMSE department at Iowa State University. 

Kent CN, Guttilla Reed IK. Regulation of Epithelial–Mesenchymal Transition in Endometrial Cancer: Connecting PI3K, Estrogen Signaling, and MicroRNAs. *Clinical and Translational Oncology.* 2016; 18:11: 1056–1061. (University of Saint Joseph)

This review article discusses the role of epithelial-mesenchymal transition in the progression and metastasis of endometrial cancer, specifically Type I vs. Type II cancers. Metastasis

is the spread of cancer from the primary site to other organs and is responsible for the majority (90 percent) of cancer-related deaths. Current research in the field is discussed with a focus on the role of estrogen signaling and microRNA regulation. Importantly, this work proposes re-evaluating the current clinical classification system for endometrial cancer that is based on the presence or absence of the estrogen receptor alpha, since both Type I and Type II endometrial carcinomas exhibit estrogen signaling pathways. Irene Guttilla Reed is an associate professor of biology at the University of Saint Joseph. Caitlin Kent completed this work as an undergraduate senior as part of an independent research project and is pursuing doctoral-level study in medicinal chemistry at the University of Kansas. The research was supported by a USJ Provost Student Research Award and a Beta Beta Beta (National Biological Honors Society) Research Grant, both of which were awarded to Kent. 

Virgílio, J. Antropólogo militante, pesquisador e/ou sujeito de estudo? *Revista Antropologías del Sur*. 2015; 2: 3: 69–85. (Federal University of Santa Catarina; New University of Lisbon)

This article refers to reflections produced after conducting fieldwork about Portuguese student demonstrations that happened between 2012 and 2013. It suggests that a revision and reconstruction of methodological preconceptions are necessary while performing fieldwork in anthropology. It produces a theoretical review regarding research and activism in contemporary anthropology and opens a dialogue with what is observed in the field. Jefferson Virgílio, a PhD candidate at Lisbon University, conducted this research as an undergraduate at Federal University of Santa Catarina in Brazil. The research was supported by three Brazilian funds: FAPESC, CAPES, and CNPq. 