Undergraduate Research Highlights

Yates JR, Gunkel BT, Rogers KK, Breitenstein KA, Hughes MN, Johnson AB, Sharpe SM. Effects of N-methyl-D-aspartate Receptor (NMDAr) Uncompetitive Antagonists in a Delay Discounting Paradigm Using a Concurrent-Chains Procedure. *Behavioural Brain Research*. 2018; 349: 125–129. doi: 10.1016/j.bbr.2018.03.039. (Northern Kentucky University)

The present study determined the contribution of the NMDAr to impulsive choice in a delay discounting paradigm. We found that MK-801 and memantine impair stimulus control (i.e., decreases preference for a large reward even when its delivery is immediate). These results challenge previous research showing that NMDAr antagonists, like MK-801 and memantine, selectively alter impulsive decision making in animals. Justin Yates is an assistant professor in the Department of Psychological Science at Northern Kentucky University. Benjamin Gunkel is currently a research technician at the University of Kentucky. Katherine Rogers, Kerry Breitenstein, and Anthony Johnson are employed. Mallory Hughes is a graduate student at Western Kentucky University. Sara Sharpe is a graduate student at Eastern Kentucky University. The students conducted this research from March–June 2016. Mallory Hughes and Anthony Johnson were enrolled in PSY 492: Research in Psychology. Benjamin Gunkel, Katherine Rogers, and Sara Sharpe were paid research assistants. Kerry Breitenstein volunteered to work in the lab. The research was supported by a Kentucky Biomedical Research Infrastructure Network (KBRIN) Investigator Development Award (NIGMS grant 8P20GM1034436-14) and a Northern Kentucky University Faculty Project Grant.

Cobbs JB, Sparks BD, Tyler BD. Comparing Rivalry Effects across Professional Sports: National Football League Fans Exhibit Most Animosity. *Sport Marketing Quarterly*. 2017; 26: 235–246. (Northern Kentucky University)

This study analyzes a sample of 4,828 sports fans across five different leagues: MLB, MLS, NBA, NFL, and NHL. Utilizing four dependent measures of acrimonious reactions to rivals (i.e., schadenfreude, disidentification, prejudice, and relationship discrimination), our MANOVA findings demonstrate a pattern of differences in rivalry among the five professional leagues. Most starkly, fans of NFL teams generally exhibit greater animosity toward their rivals compared to all other professional leagues. While fan identification does not vary significantly across leagues, more highly identified fans react to rivals with greater animosity compared to fans with lower identification with their favorite team. Joe Cobbs is an associate professor of sports business at Northern Kentucky University; David Tyler is an associate professor of sport management at Western Carolina University. Daniel Sparks recently graduated with a bachelor's degree in business administration and now works for Kentucky Speedway. This research was supported by a summer fellowship from the Haile/U.S. Bank Foundation through the NKU College of Business. (See also the podcast concerning this article, https://youtu.be/xRPGPZXg_js)

Lin H, Ourari S, Huang T, Jha A, Briggs A, Bigagli N. Photonic Microwave Generation in Multimode VCSELs Subject to Orthogonal Optical Injection. *Journal of the Optical Society of America B*. 2017; 34: 11: 2381-2389. doi: 10.1364/JOSAB.34.002381. (Bates College)

This paper studied experimentally the effect of polarized optical injection on a multi-transverse mode vertical-cavity surface-emitting laser (VCSEL), in which the polarization of optical injection is orthogonal to the dominant polarization of the VCSEL. We obtained high frequency, tunable microwave signals through polarization switching and frequency locking caused by dual beam injection in the multimode regime. The measurements show that multi-transverse mode regime is more effective than single transverse mode regime for microwave generation. Our results will be of use for dynamics in semiconductor lasers and for generation of microwave signals for wireless access networks and radio-over-fiber technology. Hong Lin is professor of physics at Bates College. Five students participated in the project from fall 2014 to 2017 as thesis students and summer research assistants: Salim Ourari ('18), Tianyao Huang ('19), Aashu Jha ('17), Andrew Briggs ('15), and Niccolo Bigagli ('17). Briggs and Jha are in graduate school in electrical engineering at the University of Texas at Austin and Princeton University respectively. Bigagli is in graduate school in physics at Columbia University. Ourari is a senior majoring in physics and will attend graduate school in electrical engineering at Princeton University. Huang is a rising senior and plans to apply to graduate school in 2018–2019. The research was supported by the Bates College Faculty Development Fund and the Bates College Faculty-Student Summer Research Fund.

Scanga SE, Hasanspahič B, Zvorničanin E, Samardžić Kozenjić J, Rahme AK, Shinn-Thomas JH. Erythritol, at Insecticidal Doses, Has Harmful Effects on Two Common Agricultural Crop Plants. *PLoS ONE*. 2018; 13: 4: e0192749. doi: 10.1371/journal.pone.0192749. (Utica College)

Erythritol, a non-nutritive polyol and the main component of the artificial sweetener Truvia®, may have potential as an organic insecticide, given its harmful effects on several insects but apparent safety for mammals. However, for erythritol to have practical use as an insecticide in agricultural settings, it must have neutral to positive effects on crop plants. This study examined the dose-dependent effects of erythritol on corn and tomato seedling growth and seed germination. Our results suggest erythritol may have damaging nontarget effects on certain plant crops when used daily at the typical doses needed to kill insect pests. Furthermore, if erythritol's damaging effects extend to certain weed species, it also may have potential as an organic herbicide. Sara Scanga and Jessica Shinn-Thomas are associate professors of biology at Utica College. Two of the student coauthors were working on related research with Shinn-Thomas prior to enrolling in BIO325: Botany in the spring 2017 semester, which requires that students conduct original research; the four students developed this idea to satisfy this course requirement. All four students graduated in spring 2017. Bilal Hasanspahič will be attending the University at Buffalo Medical School. Edin Zvorničanin will be attending SUNY Upstate Medical School. Jasmina Kozenjić is attending Salus University Pennsylvania College of Optometry. Andrew Rahme is applying to law school.

Boyd AD, Lopez KD, Lugaresi C, Macieira T, Sousa V, Acharya S, Balasubramanian A, Roussi K, et al. Physician Nurse Care: A New Use of UMLS to Measure Professional Contribution: Are We Talking about the Same Patient a New Graph Matching Algorithm? *International Journal of Medical Informatics*. 2018; 133: 63-71. doi: 10.1016/j.ijmedinf.2018.02.002. (University of Illinois at Chicago)

The objective of the study is to gain insight into interprofessional care by developing a computational metric to identify similarities, related concepts and differences in physician and nurse work. Fifty-eight physician discharge summaries and the corresponding nurse plans of care were transformed into Unified Medical Language System (UMLS) Concept Unique Identifiers (CUIs). MedLEE, a Natural Language Processing (NLP) program, extracted "physician terms" from free-text physician summaries. The nursing plans of care were constructed using the HANDS© nursing documentation software. The physician's and nurse's terms were compared using the UMLS network for relatedness. We reveal the relationships between the care provided by each professional that is specific to the patient level. Andrew Boyd is assistant

professor of biomedical and health information sciences at the University of Illinois at Chicago (UIC). Karen Dunn Lopez is assistant professor in the UIC Department of Health Systems Science. Camillo Lugaresi is now employed at Google, and Abhinaya Balasubramanian is now employed at Yahoo. Sabita Acharya is a PhD student at UIC. Khawllah Roussi is a biochemistry major in UIC's College of Liberal Arts and Sciences.

Kangas MJ, Wilson CL, Burks RM, Atwater J, Lukowicz RM, Garver B, Mayer M, Havenridge S, Holmes AE. An Improved Comparison of Chemometric Analyses for the Identification of Acids and Bases with Colorimetric Sensor Arrays. *International Journal of Chemistry*. 2018; 10: 2: 36–55. (Doane University)

Colorimetric sensors arrays use the color responses from multiple sensors to identify and quantify analytes. Chemometric analysis is usually performed to analyze and classify the colorimetric information gained from the arrays. However, very few studies have been conducted to compare the performance of several different chemometric classification methods with colorimetric sensor arrays. The present study compared the performance of seven different classification methods to identify and quantify over 600 acidic and basic sample analytes using Red Green and Blue data from a sensor array. It was found that out of all seven classification methods, linear discriminant analysis was the most effective with greater than 99 percent accuracy. Michael Kangas and Christina Wilson are postdoctoral fellows at Doane University. Raychelle Burks is an assistant professor at St. Edward's University. Billy Garver is an adjunct instructor of mathematics, Andrea Holmes is a professor of chemistry, and Miles Mayer is an adjunct instructor of chemistry at Doane University. Jordyn Atwater is currently employed in the science workforce and will apply for medical school in 2019. Rachel Lukowicz is currently in a PhD program in neuroscience at the University of Oregon. Shana Havenridge completed a master's degree in applied math at Glasgow University in Scotland. This research was supported by grants from the National Science Foundation, the National Institute of Health-INBRE, DoD-SBIR, and NSF-IRES.

Duke T, Farruggia SP, Germo GR. "I don't know where I would be right now if it wasn't for them": Emancipated Foster Care Youth and Their Important Non-Parental Adults. *Children and Youth Services Review*. 2017; 76: 65–73. doi: 10.1016/j.childyouth.2017.02.015. (University of Illinois at Chicago)

Research has identified the benefits of having non-parental adults for older youth in foster care, but less is known about the characteristics of these relationships, as well

as the processes that support the foster youth as they transition from care to independence. The study included a group of 99 young adults, who recently emancipated from care in a major U.S. city. They reported having an important non-parental adult (VIP). Sixty-three VIPs were also included in this study. The youth participated in a two-hour in-person interview followed by a survey; the VIPs underwent a phone interview. These results call for the foster care system to take steps in helping youth build relationships with the non-parental adults in their lives. Susan Farruggia is assistant vice provost of undergraduate affairs and affiliated faculty in psychology at the University of Illinois at Chicago. Gary R. Germo is assistant professor in the Department of Human Services at California State University, Fullerton. Taylor Duke performed this research as a fourth-year student and is currently in medical school at the University of Illinois College of Medicine.

Rollins L, Cloude EB. Development of Mnemonic Discrimination during Childhood. *Learning & Memory*. 2018; 25: 294–297. doi: 10.1101/lm.047142.117. (Christopher Newport University)

The present study examined mnemonic discrimination in 5- and 6-yr-old children, 8- and 9-yr-old children, 11- and 12-yr-old children, and young adults. Participants incidentally encoded pictorial stimuli and subsequently judged whether targets (i.e., repeated stimuli), lures (i.e., mnemonically related stimuli), and foils (i.e., novel stimuli) were old, similar, or new. Compared to older age groups, younger children were more likely to (1) incorrectly identify lures as "old" (rather than "similar") and (2) fail to recognize lures altogether, especially when lures were more mnemonically distinct from targets. These results suggest age-related improvements in pattern separation and pattern completion during childhood. Leslie Rollins is assistant professor of psychology at Christopher Newport University (CNU). Elisabeth Cloude is a 2016 graduate of CNU and is currently a student in the Applied Cognition and Human Factors doctoral program at North Carolina State University.

Kim C, Adil A, Bayliss RD, Kinnibrugh TL, Lapidus SH, Nolis GM, Freeland JW, et al. Multivalent Electrochemistry of Spinel MgxMn3–xO4 Nanocrystals. *Chemistry of Materials*. 2018; 30: 5: 1496–1504. doi: 10.1021/acs.chemmater.7b03640. (University of Illinois at Chicago)

Oxides undergoing reversible electrochemical cycling of Mg2+ ions would enable novel battery concepts beyond Li+, capable of storing large amounts of energy. However, materials showing this chemical reactivity are scarce. These findings open the door for the use of similar nanocrystals in Mg batteries provided that electrolytes with suitable anodic stability are discovered, thereby identifying novel routes toward electrode materials for batteries with high energy. Chungjoong Kim is in the Department of Materials Science and Engineering at Chungnam National University. Ryan D. Bayliss is a senior research scientist at Corning. Tiffany L. Kinnibrugh, Saul H. Lapidus, and John W. Freeland work for the Argonne National Laboratory. Jordi Cabana is associate professor of chemistry and Gene M. Nolis is a graduate student at the University of Illinois at Chicago (UIC). Abdullah Adil worked on this research as a third- and fourth-year UIC student and as the recipient of a UIC Chancellor's Undergraduate Research Award and Liberal Arts and Sciences Undergraduate Research Initiative funding. He is now employed as a research intern at the NIH. This work was supported by Joint Center for Energy Storage Research, DOE, NSF, National Research Foundation of Korea, UIC Chancellor's Undergraduate Research Award, and LAS Undergraduate Research Initiative.

Johnson LE, Wilkinson T, Arosio P, Melman A, Bou-Abdallah F. Effect of Chaotropes on the Kinetics of Iron Release from Ferritin by Flavin Nucleotides. *Biochimica et Biophysica Acta–General Subjects*. 2017; 1861: 12: 3257–3262. doi: 10.1016/j.bbagen.2017.09.016. (SUNY Potsdam)

The present study examined the iron release kinetics from the main iron storage protein, ferritin, in the presence of various chaotropic agents. The data indicate that iron mobilization by the non-enzymatic FMN/NAD(P)H system is limited by the concentration of FMNH2 and is independent on the type or amount of chaotropes present. Diffusion of FMNH2 through the ferritin pores is an unlikely mechanism for ferritin iron reduction; rather, an iron mobilization mechanism involving rapid electron transfer through the protein shell is proposed. We cautioned researchers about proper interpretation of the iron mobilization kinetics from ferritin using the FMN/NAD(P)H system and pointed out that these kinetics are highly dependent on the amount of dissolved oxygen and the concentration of reagents used. Fadi Bou-Abdallah is a professor of chemistry at SUNY Potsdam. Artem Melman is an associate professor of chemistry at Clarkson University. Paolo Arosio is a professor of molecular biology at the University of Brescia. Tyler Wilkinson graduated from Clarkson University in 2016 with a bachelor's degree in chemistry. Lindsay Johnson graduated from SUNY Potsdam in May 2017 with a bachelor of science in biochemistry. She is currently employed at Regeneron Pharmaceuticals in Albany, NY, as a biotech production specialist II. She worked on this project in her senior year for research credits. This work was supported by the National Institute of Health, Award Numbers R15GM104879 (F.B.A.) and NSF award CHE 1150768 (A.M.).