

UNDERGRADUATE RESEARCH Highlights

Talamantes D, Biabini N, Dang H, Abdoun K, Berlemont R. Natural Diversity of Cellulases, Xylanases, and Chitinases in Bacteria. *Biotechnology for Biofuels*. 2016; 9:133. (California State University–Long Beach)

We identified 40,946 multi-domain/multi-activity proteins targeting cellulase, chitinase, and xylanase derived from 11,953 sequenced bacterial genomes and proposed new candidate lineages and protein architectures for carbohydrate processing that may play a role in biofuel production. All researchers worked on this project mid-2015 to mid-2016. Darrian Talamantes is an undergraduate majoring in microbiology and worked on this research as a volunteer in the lab. Nazmehr Biabani is applying to graduate school; she worked on this research as a volunteer. Hoang Dang is an undergraduate majoring in biochemistry; he worked on this research under a program called Building Infrastructure Leading to Diversity (BUILD). Kenza Abdoun is an undergraduate student in biological sciences and worked on this project as a volunteer. Renaud Berlemont is assistant professor (bioinformatics and microbial genomics) in the Department of Biology at CSULB. The research was supported by the CSU Program for Research and Education in Biotechnology (CSUPERB) and the National Institute of General Medical Sciences of the National Institutes of Health. 

Barnett JL, Cherrette VL, Hutcherson CJ, So MC. Effects of Solution-Based Fabrication Conditions on Morphology of Lead Halide Perovskite Thin Film Solar Cells. *Advances in Materials Science and Engineering*. 2016; 4126163. (California State University–Chico)

We presented a critical review of the effects of processing conditions on the morphology of methylammonium lead iodide perovskite solar cells. Although difficult to decouple from synthetic and film formation effects, a single morphological feature, specifically grain size, has been evidently linked to the photovoltaic performance of this class of solar cells. In this work, we discuss experimental aspects of optimizing the (a) temperature and time of annealing, (b) spin-coating parameters, and (c) solution temperature of methylammonium iodide (MAI) solution. Jeremy L. Barnett is double majoring in chemistry and biochemistry. Vivien L. Cherrette is completing her B.S. in chemistry and minor in mathematics, whereas Connor J. Hutcherson is majoring in chemistry. All three students contributed equally to the review during spring 2016 for independent research and plan on applying to graduate programs in fall 2016. Monica C. So

is an assistant professor of chemistry. Support was provided by California State University–Chico start-up funds. 

Smolyaninova V, Jensen C, Zimmerman W, Johnson A, Shaefer D, Smolyaninov I. Lithographically Fabricated Magnifying Maxwell Fisheye Lenses. *Photonics*. 2016; 3:8. (Towson University)

Magnifying Maxwell fisheye lenses, which are made of two half-lenses of different radii, have been fabricated using photolithography and characterized. The lens action is based on control of polarization-dependent effective refractive index in a lithographically formed tapered waveguide. We have studied wavelength and polarization dependent performance of the lenses and their potential applications in waveguide mode sorting. Vera Smolyaninova and David Schaefer are professors of physics at Towson University. Christopher Jensen and Anthony Johnson are graduate students in physics at Towson. William Zimmerman, physics major at Towson, participated in the research for independent study credit. Zimmerman graduated from Towson University in May 2016 and was accepted to the Professional Master's Program in Applied Physics at Towson University. Igor Smolyaninov is a research scientist with the Department of Electrical and Computer Engineering at the University of Maryland–College Park. This research was supported in part by FCSM Undergraduate Research and Towson Undergraduate Research Grants, which were awarded to Zimmerman, and by NSF grant DMR-1104676 at Towson University. 

Onochie C, Barendolts E, Kukreja S. High-Dose Vitamin D2 Supplementation for a Year Does Not Cause Serious Adverse Events Such as Emergency Room Visits and Hospitalizations in African American Men with a High Burden of Chronic Disease. *Endocrine Practice*. 2016; 22:5: 643–644. (University of Illinois at Chicago and Jesse Brown VA Medical Center)

The study assessed the long-term safety of high-dose vitamin D2 supplementation in a double blind placebo controlled randomized trial for African American male veterans with dysglycemia and hypovitaminosis D. All subjects received cholecalciferol (D3) 400 IU as multiple vitamins and either weekly ergocalciferol (D2) 50,000 IU or placebo. The SAEs, including emergency room visits and hospitalizations, were collected from the computerized patient record system at three time points: a year prior to the trial (T0), a year of the trial (T1), and a year after the trial (T2). Correlation

and regression analysis supported that high-dose vitamin D supplementation for a year did not cause an increase in serious adverse events in this population with high burden of chronic disease. As a senior at the University of Illinois at Chicago, Chizelle Onochie participated in the project as a part of independent research for the Honors College. She worked as a volunteer researcher for this project from 2013–2016 and currently is a 2019 MD candidate attending Indiana University School of Medicine. Elena Barengolts is a professor of medicine at the University of Illinois at Chicago and the chief of endocrinology at the Jesse Brown VA Medical Center. Subhash Kukreja is a professor of medicine at the University of Illinois at Chicago. The study was supported by a Merit Review grant funded by the Department of Veterans Affairs, Jesse Brown VA Medical Center, and in part by NIH grant number UL1RR029879. 

Heyward FD, Gilliam D, Coleman MA, Gavin CF, Wang J, Kaas G, Trieu R, Lewis J, Moulden J, Sweatt JD. Obesity Weighs Down Memory through a Mechanism Involving the Neuroepigenetic Dysregulation of Sirt1. *Journal of Neuroscience*. 2016; 36:1324–1335. (University of Alabama at Birmingham)

How does obesity make memory go bad, and what are the underlying molecular mechanism that drive this decline? Researchers found that epigenetic changes dysregulate memory-associated genes, and a particular enzyme in brain neurons of the hippocampus appears to be a link between chronic obesity and cognitive decline. Specifically, they found reduced amounts of one particular memory-associated gene product—SIRT1—as the principal pathogenic cause of obesity-induced memory impairment. Frankie D. Heyward is a PhD candidate in neuroscience at University of Alabama at Birmingham (UAB). Cristin Gavin is an assistant professor in the Department of Neurobiology and co-director of the Undergraduate Neuroscience Program at UAB. Jing Wang is a research associate in UAB's Department of Neurobiology. Garrett Kaas is research assistant professor in the Department of Pharmacology at Vanderbilt University. John Lewis is pursuing graduate studies to become a genetic counselor. Jerome Moulden is a graduate student at UAB. J. David Sweatt is chair of the Department of Pharmacology at Vanderbilt University. Daniel Gilliam and Richard Trieu conducted this research as part of the Undergraduate Neuroscience Program and Science and Technology Honors Program at UAB. Gilliam matriculated in Harvard's doctoral program in neuroscience in fall 2016, and Trieu will be graduating in spring 2017. This work was supported by NIH grants T32HL105349, MH57014, P60DK079626, P30DK56336.

Amblee V, Jeffery CJ. Physical Features of Intracellular Proteins that Moonlight on the Cell Surface. *PLoS One*. 2015; 10(6), e0130575. (University of Illinois at Chicago).

Vaishak Amblee's project focused on a subset of moonlighting proteins that have a canonical biochemical function inside the cell and perform a second biochemical function on the cell surface in at least one species. We identified 30 types of these proteins. Although a variety of intracellular proteins (enzymes, chaperones, etc.) are observed to be reused on the cell surface, for the most part, these proteins were found to have physical characteristics typical of intracellular proteins. The increasing number and variety of known moonlighting proteins suggest that there may be more moonlighting proteins than previously thought, and moonlighting might be a common feature of many more proteins. Constance Jeffery is an associate professor of biological sciences at the University of Illinois at Chicago. Vaishak Amblee was a member of the Jeffery Lab from 2011 through 2013. He was a member of the Honors College and completed his capstone project with Jeffery. He also participated in annotation of the MoonProt Database (moonlightingproteins.org) and is currently in medical school. Amblee's participation in the research was supported by the UIC Office of Undergraduate Research in the Office of the Vice Provost for Undergraduate Affairs. 

Martyn-Nemeth P, Quinn L, Menon U, Shrestha S, Patel C, Shah G. Dietary Profiles of First-Generation Asian Indian Adolescents in the United States. *Journal of Immigrant and Minority Health*. 2016. (University of Illinois at Chicago)

This study sought to examine the dietary patterns, demographic characteristics, and health characteristics of first-generation South Asian Indian (SAI) adolescents living in the United States. SAIs have a high prevalence of cardiovascular disease and diabetes, and dietary behaviors contribute to this risk profile. A cross-sectional observational study design was employed with 56 adolescents from four community centers in the Chicago metropolitan area. Findings revealed several unhealthy dietary patterns: high saturated fat and sodium intake, as well as insufficient potassium, calcium, magnesium, and vitamin D intake. These trends can be reversed by advocating for greater consumption of low-fat dairy products, and more fruits and vegetables. Pamela Martyn-Nemeth is assistant professor and Laurie Quinn is professor at the University of Illinois at Chicago. Usha Menon is professor of nursing at the University of Arizona. At the time of this study, Sakun Shrestha and Grishma Sha were graduate students (nursing and public health respectively), and Chaula Patel was an undergraduate nursing student; the study was part of Patel's honors capstone in 2013–2014. All three stu-

dents are now working in their respective professions. This study was supported in part by the University of Chicago: Diabetes Research and Training Center: NIH-NIDDK: P60 DK020595-32S3 and by the UIC College of Nursing Internal Research Support Program (IRSP). 

Li I, Babajanova G, Tuomala M, Simonson RD. Smartphone Diffusion and Consumer Price Comparison Shopping Behavior: Implications for the Marketplace Fairness Act. *Economics Bulletin*. 2016; 36(3): 1337–1353. (Minnesota State University Mankato)

Taxation of e-commerce sales is a contested issue with a potentially large impact on sales tax revenue collected by local and state governments. We examine the impact of Nexus and effective online sales taxes on smartphone-assisted online purchases. We estimate that smartphone consumers are 6% more likely to comparison shop and 74% less likely to purchase from an online retailer if they live in a state with a Nexus sales tax. The implied tax elasticity of online purchases (6.8) is significantly higher than comparable recent estimates. These results suggest that local and state government forecasts of online sales tax revenue under the Marketplace Fairness Act legislation may be lower than previous estimates. Ishuan Li is associate professor of economics and Robert Simonson is professor of economics at Minnesota State University Mankato. Guncha Babajanova is employed and is applying to PhD programs in finance and economics. Matthew Tuomala is an analyst at Reeher LLC. 

Brez, CC, Allen, J. Adults' Views on Mathematics Education: A Midwest Sample. *European Journal for Science and Mathematics Education*. 2016; 4: 155–160. (Indiana State University)

This study addressed adults' beliefs and attitudes regarding math and math education in the United States. While we know about students' beliefs about math, we don't know as much about the greater population's views regarding this topic. Understanding the public's opinion is important for teachers who are trying to understand parents' attitudes toward math (specifically helping their children with math) as well as understanding support for public policy regarding math education. Caitlin Brez is an assistant professor of psychology at Indiana State University. Jessica Allen worked on this project as a senior taking research practicum course Psy 486. As part of her coursework, she worked as a research assistant in Brez's laboratory and completed data analysis for this project. She continued to work with Brez after graduation to prepare the manuscript for publication. Allen currently is a graduate student in the Clinical Mental Health Counseling program at Indiana State University. 

Kuminski E, Shamir L. Computer-generated Visual Morphology Catalog of ~3,000,000 SDSS Galaxies. *The Astrophysical Journal Supplement Series*. 2016; 223(2): 20. (Lawrence Technological University)

The study applied computer vision to classify approximately 3 million Sloan Digital Sky Survey (SDSS) galaxies and produced the largest catalog of its kind to date. It is now included in the SDSS main database, and its availability to the community will allow better understanding of the composition of the universe and the correlation between the morphology and the physical characteristics of galaxies. The paper was an American Astronomical Society (AAS) editor pick, and the findings were reported by the popular press such as *The Atlantic*. The research was done as classroom-based research experience (CRE) in two consecutive computer science courses: Computer Science 2 and Data Structures. Evan Kuminski is a junior in computer science and Lior Shamir is an associate professor of computer science at Lawrence Technological University. 

Savell KE, Gallus NV, Simon R, Brown J, Revanna J, Osborn MK, Song EY, O'Malley JJ, Stackhouse CT, Norvil A, Gowher H, Sweatt JD, Day JJ. Extra-coding RNAs Regulate Neuronal DNA Methylation Dynamics. *Nature Communications* 2016; 7: 12091. (University of Alabama at Birmingham)

The creation of memories in the brain involves addition or removal of methyl groups at precise spots on chromosomal DNA. But what controls the careful targeting of these neuronal DNA methylation dynamics? eRNAs, they say, are fundamental regulators of DNA methylation patterns in the adult brain through interaction with DNA methyltransferase enzymes, and the eRNAs may offer a promising future therapeutic avenue to treat neuropsychiatric disease states associated with changes in DNA methylation. Katherine E. Savell, Nancy V. N. Gallus, Mary Katherine Osborn, John J. O'Malley, and Christian T. Stackhouse are graduate students at the University of Alabama at Birmingham (UAB). Esther Y. Song graduated with a master's degree from UAB. Jordan Brown is in the graduate program at the Vanderbilt University School of Medicine. Allison Norvil and Humaira Gowher are graduate students in biochemistry at Purdue University. J. David Sweatt is chair of the Department of Pharmacology at Vanderbilt University. Jeremy J. Day is an assistant professor in the Department of Neurobiology at UAB. Jasmin Revanna is an undergraduate researcher in UAB's Undergraduate Neuroscience program. Rhiana Simon has matriculated in the graduate school at the University of North Carolina at Chapel Hill, and Revanna continues her research in Day's lab until her graduation in 2019. This

work was supported by NIH grants DA034681, DA039650, MH091122 and MH57014; DARPA grant HR0011-12-1-0015; and startup funds from UAB and the Evelyn F. McKnight Brain Research Foundation. 

Cheng H, Chen T, Tor M, Park D, Zhou Q, Huang JB, Khatib N, Rong L, Zhou G. A High-Throughput Screening Platform Targeting PDLIM5 for Pulmonary Hypertension. *Journal of Biomolecular Screening*. 2016; 21(4): 333–41. (University of Illinois at Chicago)

The research aims to establish a high-throughput screening platform for PDLIM5-targeted drug discovery. The research team generated a stable mink lung epithelial cell line (MLEC) containing a transforming growth factor- β /Smad luciferase reporter with lentivirus-mediated suppression of PDLIM5 (MLEC-shPDLIM5) and measured levels of Smad2/3 and pSmad2/3. They found that in MLEC, suppression of PDLIM5 decreased Smad-dependent luciferase activity, Smad3, and pSmad3. The study suggests that this system is robust and suitable for PDLIM5-targeted drug discovery. Han Cheng and Lijun Rong are in the Department of Microbiology, College of Medicine, at the University of Illinois at Chicago (UIC). Tianji Chen, Merve Tor, Qiyuan Zhou, and Jason B. Huang are in the Department of Pediatrics at the UIC College of Medicine. Guofei Zhou is assistant professor in the department of pediatrics in the UIC College of Medicine. Deborah Park, a Goldwater Scholar, conducted this work in 2015–2016 as a senior biological sciences major at UIC. Nour Khatib conducted this work as a junior biological sciences major at UIC. The students were supported by the UIC Chancellor's Undergraduate Research Award through the UIC Office of Undergraduate Research, in addition to the sources named in the article. 

Elischberger HB, Glazier JJ, Hill ED, Verduzco-Baker L. “Boys Don’t Cry”—Or Do They? Adult Attitudes Toward and Beliefs about Transgender Youth. *Sex Roles*. 2016; 75: 197–214. (Albion College)

This study examined the attitudes and behavioral intentions of U.S. adults toward transgender youth. Participants reported favorable attitudes but expressed hesitation to allow transgender children to use the restroom aligned with their gender. Attitudes were less positive in respondents with a religious affiliation, conservative political views, stronger conformity to traditional gender norms, and stronger belief in environmental versus biological causes of transgender identity. Behavioral intentions were driven by attitudes and causal attributions, age, and (for women) personal connections

to the transgender community. The authors discuss implications for the discourse surrounding transgender youth and the need for educating the public on the development of gender identity as well as the difference between gender identity and sexual orientation. Holger B. Elischberger is an associate professor of psychological science, Eric D. Hill is assistant professor of psychological science, and Lynn Verduzco-Baker is assistant professor of anthropology and sociology. Jessica J. Glazier undertook this project as her senior honors thesis in 2015; she is currently working as a research lab coordinator at the University of Michigan and is applying to PhD programs in clinical psychology. This research was supported by Albion College's Foundation for Undergraduate Research and Creative Activity (FURSCA). 