

# UNDERGRADUATE RESEARCH Highlights

**Jolitz RD, McKay, CP.** Quantitative 3D Model of Light Transmittance Through Translucent Rocks Applied to the Hypolithic Microbial Community. *Microbial Ecology*. 2013; 66: 112-119. (NASA Ames Research Center)

The study examines the light requirements to sustain microbes living on the subsurface edges of rocks in hyperarid deserts. A radiative transfer simulation was developed to predict the transmittance of photons through such a rock. Subsurface sides were determined to be 14-24 times brighter than the basal subsurface. This implies that inhabited rocks act as a "sail" for both light and water to sustain microbes in the perilitic habitat. Chris McKay is a research scientist in the Space Sciences Division at NASA's Ames Research Center. Rebecca Jolitz is currently a graduating undergraduate senior in the mathematics and physics departments at University of California at Berkeley. She began the study as a summer intern in 2009. This research was supported by NASA's Astrobiology Program and a fellowship from the Davidson Foundation awarded to Jolitz.

**D'Souza MJ, AlAbed GJ, Earley M, Roberts R, Gerges FJ.** Manipulating In-House Designed Drug Databases For The Prediction Of pH-Dependent Aqueous Drug Solubility. *American Journal of Health Sciences*. 2013; 4:3: 137-150. (Wesley College)

One goal of this project was to create a database with searchable parameters in order to predict anticancer activity of a drug based on its chemical structure. Initial results were published in *Pharmaceutical Reviews* and the U.S. Government Accountability Office picked up this work and used it to criticize the FDA (<http://srxawordonhealth.com/2010/07/26/fda-criticized-by-the-government-accountability-office/>). A second goal was to create an online database so that clinicians could add (or improve on existing) data. Malcolm J. D'Souza is a professor of chemistry and director of sponsored research at Wesley College. Natalia Roberts is an assistant professor of biochemistry at

Georgetown University. Fady J. Gerges is director of surgical pathology at Doctors Pathology Services. Ghada J. AlAbed completed this project as a senior and graduated in 2010. She is currently employed as laboratory supervisor of the science labs at Wesley College. Melissa Earley completed her part of the project in her senior year. She is currently employed as a software developer at Highmark Blue Shield in Delaware. The work was supported by grants from the National Institute of General Medical Sciences (8 P20 GM103446-13) at the National Institutes of Health.

**Chestler SR, Grosfils EB.** Using Numerical Modeling to Explore the Origin of Intrusion Patterns on Fernandina Volcano, Galapagos Islands, Ecuador. *Geophysical Research Letters*. 2013; 40: 4565-4569. (Pomona College)

Using numerical finite element models, and targeting the Fernandina volcano as a case study, this article demonstrates how minor, volcanologically plausible geometric variations in a magma reservoir system can lead to the emplacement of radial, circumferential, and corkscrew-style intrusions akin to those that characterize many volcanoes in the Galapagos and elsewhere. This result helps resolve a problem that has intrigued geologists for some time, and, excitingly, we have now identified conditions that can lead directly to lateral intrusion of radial dikes from a shallow magma reservoir. Eric Grosfils is the Minnie B. Cairns Memorial professor of geology. Shelley Chestler led the research effort for her senior thesis research, and is currently a graduate student at the University of Washington. This project was supported in part by NASA Planetary Geology & Geophysics grants NNX08AL77G and NNX12AO49G.

**Deibler K, Basu P.** Continuing Issues with Lead: Recent Advances in Detection. *European Journal of Inorganic Chemistry*. 2013; 7: 1086-1096. (Duquesne University)

Lead contamination continues to be a great concern in the environment even though some of the uses of lead, for example, leaded gasoline, have been severely reduced. Emerging technologies in water purification have been shown to increase lead concentration in water, and recent issues with lead contamination in toys were reported in the popular media. It is now recognized that no level of lead is safe for children. During the past several years, significant progress has been made in the area of lead sensors that can detect small quantities of lead in the presence of other contaminants. In this article, we summarized emerging sources of lead contamination, regulatory issues, and recent developments of lead sensors. We believe this manuscript will garner a wide readership, from inorganic environmental chemists to those who think deeply about issues concerning metals in biology. Partha Basu is a professor in the chemistry and biochemistry department at Duquesne University. This article is a direct result of Kristine Deibler's research experience as an undergraduate Crable Fellow, a flagship fellowship for our undergraduate students. She wrote and defended her honors thesis, and the current article came from the introductory chapter of her thesis. She worked on her project for two years, and an additional manuscript is expected to come out of her research. She continued to work on this manuscript after her graduation, and currently she is pursuing her PhD in chemistry at Northwestern University.

**Rosen LD, Whaling K, Carrier LM, Cheever NA, Rökkum J.** The Media and Technology Usage and Attitudes Scale: An Empirical Investigation. *Computers in Human Behavior*. 2013; 29: 6: 2501-2511. (California State University, Dominguez Hills)

The present study developed and tested a comprehensive measurement tool for assessing up-to-date media and technology use, plus attitudes toward technology and preference for task switching. This validated scale provides a common metric for researchers studying the impact of smartphones, tablets, social media, and emerging technologies. Larry D. Rosen is a professor of psychology

and past chair of the psychology department. Kelly Whaling is currently pursuing her master's degree at California State University, Northridge. Jeff Rökkum is currently pursuing his master's degree at California State University, Dominguez Hills and is in the process of applying to doctoral programs. Kelly Whaling was supported by the National Institutes of Health Minority Access to Research Careers Undergraduate Student Training in Academic Research Program (MARC U & #8260; Star Grant No. GM008683).

**Cummins A, Garza P.** Adolescent Self-Harm Behavior and Choke by Diana López. *New Review of Children's Literature and Librarianship*. 2013; 19: 2: 79-94. (University of Texas Pan American)

Participation in the choking game, self-asphyxial risk-taking behavior, threatens the well-being of adolescents. Focusing on this problem, Diana López's novel *Choke* helps to establish the genre of the young adult problem novel presenting a social issue within a realistic work of literary fiction. *Choke* represents literature portraying adolescent self-harm behavior that could be used in programs for prevention. Amy Cummins is an assistant professor of English. Polet Garza is currently a senior majoring in psychology and Spanish at the University of Texas Pan American and assisted with this study during her junior year.

**Elton ES, Zhang T, Prabhakar R, Arif AM, Berreau LM.** Pb(II)-promoted Amide Cleavage: Mechanistic Comparison to a Zn(II) Analogue. *Inorganic Chemistry*. 2013; 52: 19: 11480-11492. (Utah State University, Miami University, University of Utah)

Two new lead(II) complexes containing an amide appendage were prepared and characterized. The amide cleavage reactivity of one of the complexes was compared to that of a zinc analog. The presence of the larger lead(II) ion was found to result in a change in the rate-determining step of the reaction pathway leading to amide cleavage. Lisa M. Berreau is a professor of chemistry at Utah State University, Rajeev Prabhakar is an associate professor of chemistry at Miami University, and Atta M. Arif is the staff crystallographer at the University of Utah. Eric Elton was an undergraduate chemistry major at Utah State University who worked

on the synthesis and reactivity portions of the project during the 2011-2012 and 2012-2013 academic years and during summer 2012. Tingtang Zhang is a computational chemistry graduate student at Miami University. Elton is currently a PhD student in chemical engineering at the University of California, Davis. The Utah State University Office of Research and Graduate Studies supported the research via a 2012 Summer Undergraduate Research and Creative Opportunities (SURCO) award to Eric Elton; an award from the National Science Foundation supported the contributions of Tingtang Zhang and Rajeev Prabhakar.

**Schap D, Guest L, and Kraynak A.** Total Offset and Medical Net Discount Rates: 1981-2012. *Journal of Forensic Economics*. 2013; 24: 2: 191-204. (College of the Holy Cross)

Medical net discount rates (MNDRs) are calculated based on the medical Consumer Price Index and using annual percentage yields on various U.S. Treasury securities of short duration. Stationarity and other time-series properties are tested for each series. The somewhat mixed results are more supportive of “total offset” (i.e., a zero MNR) than previously published research findings have been. David Schap is a professor of economics. Lauren Guest is Holy Cross Class of 2013 and began work on the project as a research assistant during summer 2012 and continued her participation as part of directed research courses in fall 2012 and spring 2013. She now works for Trio Health, whose software tracks patient data for various chronic diseases. Andrew Kraynak is Holy Cross Class of 2012 and initiated the research as part of his economics department honors thesis research during fall 2011 and continued the work as part of a directed research project during spring 2012. Kraynak is now a U.S. Navy Explosive Ordnance Disposal Officer. A grant from the May and Stanley Smith Charitable Trust supported the summer research component in 2012.

**Kenemuth JK, Hennessy SP, Hanson RJ, Hensler AJ, Coates EL.** Investigation of Nasal CO<sub>2</sub> Receptor Mechanisms in Wild-type and GC-D Knockout Mice. *Chemical Senses*. 2013; 38: 9: 769-781. (Allegheny College)

This study examined the mechanisms of nasal CO<sub>2</sub> detection in mice. In addition to typical odorants, mice and other animals are able to detect CO<sub>2</sub> concentrations below that in the expired air. We found that a small subset of olfactory receptors neurons are sensitive to CO<sub>2</sub> and that they use unique mechanisms to detect this respiratory gas. This research relates to a larger project investigating the mechanisms and causes of Sudden Infant Death Syndrome. Lee Coates is a professor of biology and neuroscience and the director of undergraduate research, scholarship, and creative activities. This work reports results from student summer research and senior projects. Jessica Kenemuth and Allison Hensler are both in dental school at the University of Pennsylvania. Shane Hennessy is in medical school at the Edward Via College of Osteopathic Medicine (VCOM), and Ryan Hanson is in medical school at the Penn State Hershey College of Medicine. The research was funded by the Wells Foundation and the Class of 1939 Student Research Fund.

**Fu JC, Hao W, White T, Yan YQ, Jones M, Jan YK.** Capturing and Analyzing Wheelchair Maneuvering Patterns with Mobile Cloud Computing. *35th Annual International Conference of the IEEE Engineering in Medicine and Biology Society*. 2013; 1: 2419-2422. (University of Central Oklahoma)

Power wheelchairs are widely used to provide independent mobility to people with disabilities. Despite great advancements in power wheelchair technology, research shows that wheelchair-related accidents occur frequently. To ensure safe maneuverability, capturing wheelchair maneuvering patterns is fundamental to enable other research, such as safe robotic assistance for wheelchair users. In this study, we proposed to record, store, and analyze wheelchair maneuvering data by means of mobile cloud computing. Specifically, the accelerometer and gyroscope sensors in smart phones are used to record wheelchair maneuvering data in real-time. Then, the recorded data are periodically transmitted to the cloud for storage and analysis.

The analyzed results are then made available to various types of users, such as mobile phone users, traditional desktop users, etc. The combination of mobile computing and cloud computing leverages the advantages of both techniques and extends the smart phone's capabilities of computing and data storage via the cloud. Jicheng Fu is an assistant professor of computer science. Travis White was a senior in computer science at the University of Central Oklahoma. The research was supported by the Oklahoma Center for the Advancement of Science and Technology (OCAST), HR12-036, and the National Institute of General Medical Sciences of the National Institutes of Health through Grant Number 8P20GM103447.

**Bishop AC, Ganguly S, Solis NV, Cooley BM, Jensen-Seaman MI, Filler SG, Mitchell AP, Patton-Vogt J.** Glycerophosphocholine Utilization by *Candida albicans*: Role of the Git3 transporter in virulence. *Journal of Biological Chemistry*. 2013; 288: 47: 33939-52. (Duquesne University, Carnegie Mellon University, UCLA)

*Candida albicans* is a pathogenic fungus and the cause of many hospital-acquired infections. This study identified and characterized novel transport proteins responsible for the uptake of the lipid metabolite, glycerophosphocholine, by *C. albicans*. Importantly, this work identified the Git3 transporter as being required for the full virulence of the organism in a mouse model of infection. Jana Patton-Vogt is an associate professor in the department of biological sciences at Duquesne University. The undergraduate involved in these studies, Ben Cooley, separated and quantified glycerophosphocholine and related metabolites in the cell. Cooley was a senior when the experiments were performed and is currently a masters student in the forensic science program at Duquesne. The research at Duquesne University was supported by an NIHR15 grant.

**Chen S, Mason N, Middleton S, Salazar W.** An Examination of Behavioral Data and Testing Scores as Indicators of Student-athletes' Academic Success. *KAHPERD*. 2013; 51: 1: 34-43. (Morehead State University)

The researchers examined behavioral data and test scores of 186 NCAA Division-I student-athletes to verify the best indicators of student-athletes' academic performance for balancing academic achievement and athletic participation. It was found that participants' academic performance (grade point average) was found to be positively correlated ( $p < .01$ ; Pearson  $r = .497$ ) with the time spent attending classes and studying, and negatively correlated with the time spent in competition, practice, and leisure activities ( $p < .01$ ; Pearson  $r = -.357$ ). The results demonstrated the importance of balancing student-athletes' academic and athletic life. The researchers provided further discussion and practical suggestions on how to work with student-athletes concerning this conundrum. Steve Chen is an associated professor of management and marketing, Morehead State University. Nick Mason is currently a senior in Morehead State University's Sport Management Program. Mason has been an undergraduate research fellow for the last three years working with his mentor, Steve Chen. The project was funded by the Center for Regional Engagement of Morehead State University.