UNDERGRADUATE RESEARCH Highlights

Hatch CD, Wiese JS, Crane CC, Harris KJ, Kloss HG, Baltrusaitis J. Water adsorption on clay minerals as a function of relative humidity: application of BET and Freundlich adsorption models. *Langmuir*. 2012; 28:1790-1803. (Hendrix College)

Water adsorption on the three most abundant clay minerals found in the atmosphere, including kaolinite, illite and montmorillonite, was measured as a function of relative humidity (RH), using an attenuated total reflectance (HATR) Fourier transform infrared (FTIR) spectrometer equipped with a flow cell. The measured water content was in excellent agreement with previous data and was fit using the BET and Freundlich adsorption isotherm models. Although the BET model represents the data well at low RH (<60% RH), fit integrity is lost at higher RH. Upon fitting the Freundlich model to the data, two distinct adsorption regimes are revealed in all three clays. The variability in adsorption properties observed was attributed to different water uptake mechanisms by the three clays.

Courtney Hatch is an assistant professor of chemistry at Hendrix College. Jadon Wiese currently attends the University of Arkansas Medical School.Cameron Crane is in graduate school in chemistry at the University of Arkansas. Kenneth 'Josh' Harris is still enrolled at Hendrix College. Gracie Kloss is in pharmacy school at the University of Tennessee. This study was supported by NSF (#ATM-0928121) and by a single investigator Cottrell College Science Award. Jadon Wiese received support from an ASGC Research Infrastructure Grant. Cameron Crane received support from the Hendrix Odyssey Program.

Burke K, Riccardi C, Buthelezi T.
Thermosolvatochromism of nitrospiropyran and merocyanine free and bound to cyclodextrin. *Journal of Physical Chemistry*. B 2012; 116:8:2483-2491. (Wheaton College)

We investigated the thermosolvatochromism of nitrospiropyran and merocyanine free and bound to cyclodextrin in dimethysulfoxide (DMSO)-water binary system. The nitrospiropyran interconverts to merocyanine in response to heat or light. We converted nitrospiropyran (SP) to merocyanine (MC) by heating the sample to 55 °C. When cooled to 25 °C the MC sample converted back to SP. We found that the interconversion of spiropyran to merocyanine in DMSO-water is stable and does not suffer from thermal or photofatigue. Acquired steady-state absorption and emission spectra reveal that the merocyanine free and bound to cyclodextrin could be used as a polarity probe for DMSO-water binary solutions.

Thandi Buthelezi, PhD, is an assistant professor of chemistry Kathryn Burke, biology major, participated in the research during her senior year as a Wheaton Research Partnerships research assistant. Kathryn graduated in May 2012, and is employed. She is in the process of applying to graduate programs. Caterina Riccardi, a chemistry major, participated in the research during her senior year for independent study credit. She graduated in May 2011 and will start a PhD program in chemistry at the University of Connecticut in fall 2012. The research was supported by Wheaton College.

Gurung RAR, Wilhelm TM, Filz T. Optimizing honor codes for online exam administration. Ethics & Behavior 2012; 22:2:1-5. (University of Wisconsin-Green Bay)

This study examined self-reported academic dishonesty at a mid-sized public university. Students (N = 492) rated the likelihood they would cheat after agreeing to abide by each of eight honor code pledges before internet based assignments and examinations. The statements were derived from honor pledges used by different universities across the United States and varied in length, formality, and the extent to which the statements included consequences for academic dishonesty. Longer, formal honor codes with consequences were associated with a lower likelihood of cheating. Results showed a significant three-way interaction and suggest how to best design honor codes.

Tiffany is currently in the doctoral program at Marquette University. Tonya starts graduate work at Auburn University this fall.

Posner M, Kiss AJ, Skiba J, Drossman A, Dolinska MB, Hejtmancik JF, Sergeev YV. Functional validation of hydrophobic adaptation to physiological temperature in the small heat shock protein αA-crystallin. *PLoS One*. 2012; 7:3:e34438. (Ashland University)

This study examined the evolution of protective function in the small heat shock protein αA-crystallin. Small heat shock proteins are used to maintain cellular health in many cell types and their dysfunction is related to diseases such as Alzheimer's, cataracts and cancer. By examining the structure and function of αA-crystallin from six fish species adapted to different environmental temperatures, we identified two amino acid changes that increase this protein's ability to prevent the aggregation of other proteins. Our results show that a comparative approach can be used for insight into the design of small heat shock proteins with enhanced protective ability.

Mason Posner is professor of biology and chair of the Department of Biology/Toxicology at Ashland University. Jackie Skiba graduated in 2010 and currently works in quality control for the coffee division of the Smuckers Corporation. Amy Drossman graduated in 2011 and is continuing her studies at the Illinois College of Optometry. This research was supported by an AREA grant from the National Eye Institute (R15 EY13535) to Mason Posner.

Hossain A, Humphrey L, Mian A. Prediction of the dynamic response of a mini-cantilever beam partially submerged in viscous media using finite element method. *Finite Elements in Analysis and Design* 2012; 48:1:1339-1345. (Montana State University)

In this work, the use of mini cantilever beams for characterization of rheological properties of viscous materials is demonstrated. The dynamic response of a mini cantilever beam partially submerged in air and water is measured experimentally using a duel channel PolyTec scanning vibrometer. The changes in dynamic response of the beam such as resonant frequency, and frequency amplitude are compared as functions of the rheological properties of fluid media. Next, finite element analysis method is adopted to predict the dynamic response of the same cantilever beam and then compared with experimental results already performed to validate the FEA modeling scheme. After model validation, further numerical analysis was conducted to investigate the variation in vibration response with changing fluid properties.

Awlad Hossan is an assistant professor of mechanical engineering at Eastern Washington University. Ahsan Mian is an associate professor of mechanical engineering at Montana State University. Luke Humphrey performed the experimental portion of the research at Montana State University (MSU) during the academic year 2010-2011. He did this work was as part of his independent study credit. Luke completed his BS in mechanical engineering at MSU in December 2011. He will start PhD at Georgia Tech in fall 2012.

Rhoads DE, Grimes N, Kaushal S, Mallari J, Orlando K. Decision time and perseveration of adolescent rats in the T-maze are affected differentially by buspirone and independent of 5-HT-1A expression. *Pharmacology Biochemistry & Behavior* 2012; 102:58-63. (Monmouth University)

The present study examined induced repetitive behaviors of rats as a model for aspects of human obsessive compulsive disorder. Rats responded to buspirone with vicarious trial and error behavior and prolonged decision time in the baited T-maze. Adolescent Long-Evans rats were uniquely unresponsive to buspirone. Receptor protein expression and a selective receptor antagonist were used to show that these effects of buspirone were independent of the brain serotonin 1A receptor.

Dennis Rhoads is a professor of biology. Sunaina Kaushal is a medical student at Drexel University and worked for two years on this project to fulfill requirements of the University Honors program. Janine Mallari is in the process of applying to graduate and medical schools and this was her independent study project. Krystal Orlando just finished her sophomore year. She began working on this project as part of the School of Science Summer Research Program and continues doing research for Departmental Honors. She plans to apply to medical school. Research was supported by the department and summer research program, and grants from the Pfizer Undergraduate Research Endeavors Science program and Benjamin Cummings/Metropolitan Association of College and University Biologists.

Amick AW, Hoegg E, Harrison S, Houston KR, Hark RR, Reingold ID, Barth D, Letzel MC, Kuck D. Site-specific hydrogen exchange and hydrogen transfer processes preceding the fragmentation of long-lived radical cations of ethyl dihydrocinnamate and related arylalkanoates. International Journal of Mass Spectrometry 2012; 316:206-215. (Washington College, Juniata College, and Bielefeld University, Germany.)

An electron ionization study on the fragmentation of metastable molecular radical cations of ethyl dihydrocinnamate, several deuterium-labeled isotopomers, and related arylalkanoic acid esters was performed by mass-analyzed ion kinetic energy (MIKE) spectrometry. A highly specific H/D interchange involving the four hydrogen atoms at the benzylic- and ortho-positions was found to occur. This represents another striking case of complete 4H–scrambling that enables the molecular ion to fully equilibrate the interchanging hydrogen atoms prior to fragmentation. A mechanism rationalizing these observations and extending previously suggested mechanisms is proposed involving a series of distonic ions and the intermediacy of an ion/neutral complex. Interestingly, this research was developed from a sophomore-level laboratory course project.

Aaron W. Amick is an assistant professor in the chemistry department at Washington College. Richard R. Hark and I. David Reingold (recently retired) are in the Chemistry Department at Juniata College. Dieter Barth, Matthias C. Letzel, and Dietmar Kuck are faculty members at Bielefeld University, Germany. Edward Hoegg and Sean Harrison worked on this project during the summer of 2010. Edward graduated in May 2011 and is currently working at the Department of Energy. Sean graduated in May 2012 and will be attending pharmacy school. Katelyn Houston worked on this project during the spring of 2011. She graduated in May 2012 and is preparing to begin a PhD program in chemistry at the University of North Carolina-Chapel Hill. This research was graciously funded by Washington College.

Hong R, Kang TY, Michels CA, Gadura N. Membrane lipid peroxidation in copper alloy mediated contact killing. Applied and Environmental Microbiology 2012; 78:6:1776-84. (Queensborough Community College, CUNY)

Copper alloy surfaces are passive antimicrobial sanitizing agents that kill bacteria, fungi, and some viruses. This study explores the hypothesis that nonenzymatic peroxidation of membrane phospholipids is responsible for copper alloy-mediated surface killing in Escherichia coli. Cell survival, lipid peroxidation levels, and DNA degradation were followed in cells exposed to copper alloy surfaces containing 60 to 99.90 percent copper or in a medium containing CuSO(4). Our results suggest that copper alloy surface-mediated killing of E. coli is triggered by nonenzymatic oxidative damage of membrane phospholipids that ultimately results in the loss of membrane integrity and cell death.

Nidhi Gadura is an assistant professor in the Department of Biological Sciences and Geology at Queensborough Community College. All the work for the publication was done at the newly established biotechnology lab at Queensborough in collaboration with Dr. Corinne Michels (Distinguished Professor Emerita) at Queens College. Tae Y. Kang started the project in 2008 as part of the NSF-STEP program and has gone on to complete his PA program and is currently working. Robert Hong took over the project in 2010 as an NSF-REU student and is still enrolled at Queensborough; he plans to pursue a PhD in the near future. The project was funded by a Professional Staff Congress-City University of New York (PSC-CUNY) grant and Copper Development Association grants to Nidhi Gadura.

Toussaint LL, Marschall JC, Williams DR. Prospective associations between religiousness/spirituality and depression and mediating effects of forgiveness in a nationally representative sample of United States adults. Depression Research and Treatment 2012. (Luther College)

This article employs the use of a nationally representative sample of United States adults in examining the extent to which religiousness/spirituality are associated with diagnosed clinical depression across time. Forgiveness was explored as a possible mediator of these associations. Results showed that religiousness/spirituality, forgiveness of oneself and others, and feeling forgiven by God were associated, both cross-sectionally and longitudinally, with depressive status. Further, forgiveness of others acts as a mechanism of the salutary effect of religiousness/spirituality; forgiveness of oneself is an independent predictor.

Loren Toussaint, associate professor of psychology at Luther College, served as the primary faculty advisor for this project. Harvard University professor, David Williams (Department of Society, Human Development, and Health; Department of African and African American Studies; Department of Sociology), also contributed. Then Luther College senior, Justin Marschall assisted on the project. Throughout his time at Luther, Marschall frequently collaborated with Toussaint, contributing to 17 different research projects over the course of two and a half years. Toussaint's laboratory for the Investigation of Mind, Body, and Spirit, is made up of about a dozen other students. Marschall graduated from Luther College in 2012 with a major in psychology and a minor in music. In August of 2012, Marschall began a PhD program at Iowa State University in social psychology. This study was supported by the Fetzer Institute, Grant T32-MH16806 from the National Institute of Mental Health, and by a Faculty Research Grant from the University of Michigan.