The University of Maryland, Baltimore County Graduate Student Association and Graduate School Presents…

The 39th Annual

GRADUATE RESEARCH CONFERENCE

March 29, 2017

9:00am - 2:30pm

University Center,
3rd Floor

GRADUATE RESEARCH CONFERENCE

Presented by:

GRADUATE STUDENT ASSOCIATION

Table of Contents

A Message from the GSA President

Welcome....

Welcome to the 39TH Annual Graduate Research Conference (GRC). The Graduate Student Association of the University of Maryland Baltimore County (UMBC) have been dedicated to this project since the beginning of the school year. Each year the GRC familiarizes graduate students with preparing for scientific meetings, and creates a forum for students in various disciplines to share their research and ideas with peers, faculty, and the entire University of Maryland community.

This year students from multiple disciplines will come together to present their work in various forms. We would like to thank each of the presenters for their time and effort to formally communicate their achievements – we commend your hard work and devotion to your field of study.

The GRC committee would like to thank everyone who has contributed to this year's conference. This day would not have been possible without the numerous members of the graduate school offices at UMBC. Specifically, we would like to acknowledge Dr. Janet Rutledge, Vice Provost and Dean of the Graduate School, Dr. Jeffrey Halverson, Associate Dean, Dr. Scott Casper, Dean of Arts, Humanities, and Social Sciences, Dr. Renetta Tull, Associate Vice Provost of Graduate Student Development, and Postdocs, and Event Planning at UMBC for their guidance and support. The Graduate Research Conference committee has been working tirelessly on creating a successful and memorable event for all graduate students, staff, and faculty. This year the Graduate Research Conference committee was composed of Madison Anderson, Evgenia Barannikova, Eleanor Brasfield, Morgan Bunting, Brittany Gay, Onimi Jademi, Molly Ricks, and Ging Shamberger, who are all graduate students at UMBC who volunteered their time, efforts, and creativity to make this event possible.

Additionally, we would like to thank the faculty members who have volunteered their time to serve as judges and mentors. Your dedication to the opportunities and advancement of your students here today, and everyday, does not go unnoticed. Finally, this day would not have been possible without the members of the GRC organizing committee – all of you are amazing and indispensable.

We hope that you enjoy your experience at this year's GRC. We have worked hard to make the day as enjoyable and informative as possible. We invite you to participate fully in this year's conference, and we look forward to welcoming you back next year. It has truly been a privilege and an honor to provide a colloquium for all students of the University of Maryland to present their achievements.

Sincerely,

Deanna Cerquetti
GSA President, UMBC

Foreword

Welcome to the 39th Annual Graduate Research Conference (GRC) at the University of Maryland, Baltimore County (UMBC)! The Graduate Student Association (GSA) is proud to host this conference to allow our graduate students, researchers, professional students, and postdoctoral fellows the opportunity to present their work. The Graduate School is a beacon to UMBC's dedication to diversity and reflects values of collaboration, innovation, excellence and inclusion that guide UMBC's culture. This year, diverse realms of research will be presented through traditional poster sessions, interdisciplinary panels, microtalks, and the Three Minute Thesis. We thank the Graduate School for their support and encouragement of GRC and the outstanding research being conducted by our graduate students and postdoctoral fellows.

We are proud to host two keynote speakers, Dr. Scott E. Casper and Dr. Jeffrey B. Halverson. Dr. Casper, Dean of the College of Arts, Humanities, and Social Science, will engage students on how to effectively communicate research during the "Dynamic Speaker" Breakfast session. Dr. Halverson, Associate Dean of the Graduate School, will present "*Celebrating 50 Years of Grit and Greatness*" as our lunch keynote. We commend Dr. Casper and Dr. Halverson for their contributions to the field of science and for sharing their messages with our campus.

The GSA gratefully acknowledges those who helped make the GRC possible and successful. We would like to thank Dr. Hrabowski, President of UMBC, for his continued support of the students on our campus and their research. We would also like to recognize Dr. Rutledge, Vice Provost and Dean of the Graduate School, for her continued guidance and support. We greatly appreciate the faculty members who donate their time to act as reviewers and judges to make GRC a valuable opportunity for students to practice and improve their skills. We thank the GSA program and organization representatives and our volunteers, for their work and commitment have helped bring GRC to fruition. We offer a special thanks to Madison Anderson, GSA Communications Manager, for her time and support to maintain communication with the graduate community and overall promotion of GRC. We sincerely appreciate Dawn Galindo for devoting her time and energy to support, advocate, and advise the GSA and GRC Planning Committee throughout the year. Finally, we would like to recognize the GRC Planning Committee for their hard work to make the GRC possible and to bring together graduate students from across campus. It is our pleasure to host you at the 39th Annual Graduate Research Conference, and we hope you enjoy today's program and events!

GSA Executive Board

Deanna Cerquetti - President
Onimi Jademi - Vice President
Daniel Miller, VP for External Affairs
Scott Riley, Treasurer
Roy Prouty, Historian

2017 GRC Planning Committee

Madison Anderson (GSA), Morgan Bunting (Chair), Evgenia Barannikova, Eleanor Brasfield, Brittany Gay, Molly Ricks, Ging Shamberger

Keynote Speaker Biographies

Dr. Scott E. Casper

Dean of the College of Arts, Humanities and Social Science

Dr. Scott E. Casper joined the UMBC community and the Dean's Office in July 2013. Dr. Casper is an engaging speaker and researcher. A historian of the nineteenth-century United States, he is the author of *Sarah Johnson's Mount Vernon: The Forgotten History of an American Shrine* (Hill & Wang, 2008). He has co-authored, edited, or co-edited eight other books. He has held research fellowships at the National Humanities Center and the Virginia Foundation for the Humanities, among other institutions.

Dr. Casper has also worked extensively with K-12 history and social studies educators through the Mount Vernon Ladies Association, the Center for Civic Education, and the Northern Nevada Teaching American History Project. He earned his A.B. from Princeton University and his M.A., M.Phil., and Ph.D. in American Studies from Yale University.

Dr. Jeffrey B. Halverson

Associate Dean of the Graduate School

Dr. Jeffrey B. Halverson has traveled the world's tropical latitudes to better understand how intense storms of rain and wind develop and intensify. He has conducted research in Brazil, Australia, the South China Sea, Costa Rica, the Marshall Islands, West Africa and various locations in the Caribbean studying tropical weather systems. Dr. Halverson's research examines the atmospheric factors that cause hurricanes to rapidly change intensity.

He also served as Associate Director-Academics at the Joint Center for Earth Systems Technology (JCET), a cooperative institute between NASA and UMBC. He also served as Deputy Project Manager at NASA Headquarters, where he managed NASA field programs to investigate hurricanes in 2005 and 2006. Dr. Halverson has authored more than 28 professional papers and writes a monthly column on severe and unusual weather for Weatherwise Magazine.

Schedule of Events

39th Annual Graduate Research Conference

University Center

March 29, 2017

9:00 - 9:30am	Registration	Third Floor
9:15 - 9:45am	"Dynamic Presenter" Breakfast *Dr. Scott E. Casper*	Ballroom
10:00 - 10:45am	Panel Session I - Media Manipulations	Ballroom Lounge
	Microtalk Session I	UC 310
11:00 - 11:45am	Panel Session II - Changing Climates	Ballroom Lounge
	Poster/Art Session I	UC 312
12:00 - 1:30pm	Lunch - *Dr. Jeffrey B. Halverson* Three-Minute Thesis Competition	Ballroom
1:45 - 2:30pm	Panel Session III - Mind the Gap	Ballroom Lounge
	Microtalk Session II	UC 310
	Poster/Art Session II	UC 312

Session Assignments

Session	Presenters (Abstract Number)
Panel Session I: Media Manipulations	Shaokang Wang (#1), Genevieve Hugenbruch (#2), Chrissie Reilly (#3), Shawntay Stocks (#4), Ruken Isik (#5)
Panel Session II: Changing Climates	Marshall Washick (#6), Michael Battaglia, Jr. (#7), Marwa El-Sayed (#8), Brent McBride (#9), Alexandra St. Pé (#10)
Panel Session III: Mind the Gap	Aayush Sharma (#11), Robert Burton (#12), Stephanie Smith (#13)
	Presenters
Microtalk Session I	Katherine Ralston, Sushant Athley, Rachael Knoblauch, Preethi Somasundaram, Josh Moskowitz, Mahdad Talebpour, Laura King, Becca Sharf, Trevor Needham, John Winder
Microtalk Session II	Tyrone E. McKoy Jr., Adam P. Dixon, Michael Zhang, Seyedahmad Mousavi, Ke He, Joshua Brown, Canessa Swanson, Sai Kumar Popuri, Gian L. McCann, Nopondo N. Esemoto
	Presenters (Abstract Number, Board Number)
Poster/Art Session I	Mary Keenan (#14, #3), Mirelis Santos Cancel (#15, #4), Adam Meares (#16, #5), Michael Zhang (#17, #6), Muhammad Mahbubur Rahman (#18, #8), Kiranmayi Prakash Mangalgiri (#19, #9), Mamatha Hopanna (#20, #10), Nopondo E. Esemoto (#21, #11), Utsav Shashvatt (#22, #12), Erica Dasi (#23, #13), Brian Cawrse (#24, #14), Yangling Zhou (#25, #15), Alexander Winton (#26, #16), Estela C. Monge (#27, #18), Heather Mutchie (#28, #19), Maraki Negesse (#29, #20), Josey Stevens (#30, #21), Saman Nezami (#31, #22), Rickesh Patel (#32, #24), Jong S. Park (#33, #25), Mary Yates (#34, #26), Brian Carroll (#35, #27), Ashley Wayne (#36, #29), Jared Marguilies (#37, #30)
Poster/Art Session II	Natalie Roberts (#38, #1), Kartikeya Joshi (#39, #3), Richard Brewster (#40, #4), Danielle Schmitt (#41, #5), Julie Nyman (#42, #6), Mahdad Talebpour (#43, #8), Josh Moskowitz (#44, #9), Marwa El-Sayed (#45, #10), Tonya Santaus (#46, #11), Rachael Knoblauch (#47, #13), Miji Jeon (#48, #14), Zheng Zheng (#49, #15), James C. Kitchin (#50, #16), Jonathan Graf (#51, #18), Mary Donohue (#52, #19), Christopher Cooper (#53, #21), Marilyn Allen (#54, #21), Zhen Qi (#55, #22), Brent McBride (#56, #24), Cassie Nelson (#57, #25), Maithili Joshi (#58, #26), Stacey Sova (#59, #27), Scott Riley (#60, #29), Therese Ku (#61, #30)

Three Minute Thesis

Three Minute Thesis (3MT®) celebrates the exciting research conducted by PhD students. Developed by The University of Queensland, the exercise cultivates students' academic, presentation, and research communication skills. The competition supports their capacity to effectively explain their research in three minutes, in a language appropriate to a non-specialist audience.

Contestant	***Title***
Janae Baptiste *Biochemistry*	*Structure Determination of the Feline Immunodeficiency Virus Matrix Protein*
Denise Williams *Chemistry*	*Bacterial impact studies of CdSe quantum dots versus ZnSe quantum dots.*
Evgenia Barannikova *Chemistry*	*Peptide-templated Assembly of Electrode Materials for Li-ion Battery*
BreAsia Deal *Applied Mathematics and Statistics*	*Oscillatory Behavior in Glycogen Formation*

Abstracts

1. **Shaokang Wang**
   Electrical Engineering

   Passively mode-locked lasers are used to generate ultra-short, high-energy, and robust optical pulses. They are also used to generate optical frequency combs, which in the past decade have revolutionized frequency metrology and have a broad array of applications. A widely-used model for passively mode-locked lasers is the Haus mode-locking equation (HME). However, this model predicts a limited stability range that is not consistent with experiments. A model whose stability range is more consistent with experiments is the cubic-quintic mode-locking equation (CQME), which has been considered both with and without gain saturation. In this work, we computationally study the stability of pulse solutions of CQME with saturable gain as we allow the strength of both the cubic and quintic nonlinearities to vary relative to the chromatic dispersion. The goal is to develop robust computational methods that will allow us to rapidly determine the existence and stability of pulse solutions as the equation parameters vary. Ultimately, we intend to apply these methods to more complex and realistic systems of equations. This simple model has a remarkably rich dynamical structure. We have found the following regimes: (1) A regime in which radiation modes are unstable. (2) Two regimes in which a single pulse shape is stable. (3) A regime in which two different pulse shapes are simultaneously stable. (4) A regime in which a shelf instability occurs. The boundary between regimes where one stable pulse shape and two stable pulse shapes exist is defined by a saddle-node bifurcation, where the amplitude of one of the two types of pulse becomes unstable. An edge bifurcation occurs prior to the shelf instability.

2. **Genevieve Hugenbruch**
   Intercultural Communication

   My research examines how the media in Germany has been representing refugees throughout the refugee crisis. The ideology behind word choices can be teased out by applying critical discourse analysis to various media outlets with a wide-range of political associations and leanings. Trends in word choices that portray refugees and migrants can be traced and associated with political motivations and policy goals. This is relevant to the panel “Media Manipulations” because the representation of actors through word choice constructs a narrative that impresses upon and influences the media’s audience. Politically-motivated word choices manipulate the audience to view the world unconsciously from an ideologically-charged perspective.

3. **Chrissie Reilly**
   Language, Literacy, and Culture
   Leave the Sword, Take the Sashimi: Eating and Organized Crime in Hollywood Movies About Japan

   Through the videographer’s lens, viewers are able to safely engage in virtual adventures with yakuza (Japanese organized crime syndicate). From unconventional heroes to dastardly villains, motion pictures introduce audiences to fascinating characters in New York, Los Angeles, Tokyo, and Osaka. Movies like Showdown in Little Tokyo, Black Rain, Rising Sun, Fast and Furious: Tokyo Drift, depict modern urban life via “fish out of water” stories. While movie-goers are swept up

into the (under)world of graft, corruption, and murder, the movies also tell a compelling story through food. This presentation will show how these films reflect a larger narrative of consumption overall, which is currently absent from existing scholarship about this genre. Food in gangster movies reflects a larger story of performative eating, the role of directors as purveyors, the role of audience as consumers, and all of this feeds into American insight about Japanese culture. Much like the way the food in Babette's Feast was a part of the narrative, food weaves throughout the stories, intertwining with the characters and scenes as if it was a character in and of itself. Meals on film are a type of performance, one that extends beyond the time actually filming the meal scene, because media can be perfectly repeated indefinitely. While the taste of food is fleeting, the appearance of a meal captured on film endures. What unites the viewers in each of these full-length movie experiences is the quest to safely consume the other, even when that other is weapon-wielding cops and criminals.

4. **Shawntay Stocks**
   Language, Literacy, and Culture

   My presentation is on the use of critical race theory and intersectionality through spoken word poetry (as a form of storytelling) to help educate people on critical diversity and issues of equity.

5. **Ruken Isik**
   Language, Literacy, and Culture

   It has been more than four years since the civil war broke out in Syria that has caused the lives of millions of Syrians. Since the start of the war, Western media has been covering the war in Syria widely. By the fall of 2014 Islamic State captured so many territories and claimed victories until it targeted a Kurdish city called Kobani in Northern Syria. The Kurdish militia women and men defended the city against the Islamic State and Kurds worldwide campaigned for military support for Kurds in Syria. With the war in Kobani, the Western media started to cover Kurdish women fighters. Although publicity is not a bad thing for these women, there are important points that needs to be addressed in these Western media news coverages and the ways in which these women are represented in the Western media. In this paper, I will analyze the coverage of Kurdish women fighters in the Western media by applying some of the concepts such as femininity/masculinity, the cultural other and intersectionality.

6. **Marshall Washick**
   Emergency Health Services
   A New Model for Climate Change and Health: Will Tuberculosis Rise Again?

   I am working to develop a conceptual framework for examining the complex relationships between climate, health, and vulnerability using tuberculosis incidence rates as an indicator of population health - particularly in Sub-Saharan Africa.

7. **Michael Battaglia Jr.**
   Chemical, Biochemical, and Environmental Engineering
   Effects of the Urban Heat Island on Aerosol

   The purpose of this study was to evaluate the effect of the urban heat island on aerosol pH. The urban heat island is a widely observed phenomenon whereby urban environments have higher

temperature than surrounding suburban and rural areas. This effect is most pronounced at night, while the seasonality varies by location. Temperature (T) and relative humidity (RH) are critical factors that affect the partitioning of semi-volatile species found in the atmosphere, such as nitric acid and ammonia. Aerosol pH, a measure of acidity, is important to numerous atmospheric processes, as it has been linked to deleterious human health and environmental effects, plays a role in atmospheric chemistry, and is inherently tied to the partitioning behavior of nitric acid and ammonia. In this study, we utilize identical aerosol gas- and particulate-phase compositions, combined with meteorological parameters (T, RH) collected at the Beltsville and Old Town field sites to simulate aerosol equilibrium partitioning using the ISORROPIA II and E-AIM thermodynamic models. Diurnal profiles of T and RH, and aerosol pH were constructed for the mean, median, 25th, 75th, and 90th percentiles. We find that the urban heat island reduces aerosol liquid water, concentrating aerosol components at thermodynamic equilibrium, and is responsible for the calculated differences in aerosol pH. In all cases, urban aerosol pH was lower (more acidic) than rural aerosol pH for identical aerosol composition, and the pH difference between urban and rural locations increased as a function of temperature difference.

8. **Marwa El-Sayed**
   Chemical Engineering
   Effects of Liquid Water Evaporation on Organic Aerosols in the Eastern United States

   The uptake of water-soluble organic gases into atmospheric liquid water (aqSOA) was identified as a major route for secondary organic aerosol (SOA) formation in the eastern United States; however, many aspects of this formation remain uncertain. A major uncertainty is the effect of drying on the concentrations of SOA, since relative humidity cycles modulate the aerosol liquid water content of particles. Here, we quantify changes in the organic aerosol mass as a result of particle drying. Water-soluble organic matter (WSOM) measurements were conducted during two consecutive summers in Baltimore, MD. The WSOM measurements were alternated through an unperturbed ambient channel and through a 'dried' channel maintained at ~35% relative humidity (RH). The average evaporated WSOM concentration due to drying was 0.65 and 1.05 g m-3 in the summers of 2015 and 2016, respectively. Evaporated WSOM concentrations were observed to increase with increasing RH, leading to higher WSOM evaporation during the night when RH levels reached their diurnal peaks. This evaporated organic mass was also linked to isoprene, an important SOA precursor. These results have implications for measurements of PM2.5 (particulate matter with aerodynamic diameter of less than 2.5 micron) using the EPA's Federal Reference and Equivalent Methods (FRM and FEM), since these methods employ sample drying to 35% RH to eliminate the contribution of aerosol water to the measured PM mass. An average bias in hourly PM2.5 concentrations measured with FEM method was inferred based on a comparison to PM2.5 measurements at the closest Maryland Department of the Environment ambient monitoring station to UMBC. Our results suggest that this phenomenon is important during the summertime in the eastern U.S. and could potentially have ramifications for compliance with the National Ambient Air Quality Standards (NAAQS).

9. **Brent McBride**
   Atmospheric Physics
   Preparing to Launch UMBC's First Full-Feature Earth Sciences Satellite: The Hyper-Angular Rainbow Polarimeter (HARP)

Aerosol-cloud interaction is among the most important and still least understood contributor to climate change. Remote sensing instruments on satellite, aircraft, and ground stations fill the vital role in sampling aerosol-cloud scenes with global coverage; their retrievals improve climate models and narrow uncertainties in estimating climate forcing. Still, traditional radiometric studies of clouds and aerosols are biased: these instruments are not sensitive to non-spherical particles and have difficulty distinguishing two different scenes with the same statistical particle size. The Laboratory for Aerosols, Clouds, and Optics (LACO) at UMBC presents the Hyper-Angular Rainbow Polarimeter (HARP) CubeSat, a wide-FOV imaging polarimeter capable of performing highly accurate retrievals of cloud and aerosol microphysical properties from space. The hyper-angular capability provides the sampling of cloud parameters at higher angular and spatial resolution than POLDER (CNES). This advanced microsatellite is positioned as a precursor to the multi-angle imaging polarimeter required for the upcoming NASA Aerosols, Clouds, and Ecosystems (ACE) mission. This presentation will discuss the polarimetric calibration and accuracy of the HARP instrument, preliminary cloudbow retrievals from the Passive Aerosol and Cloud Suite (PACS) instrument, the HARP proof-of-concept imaging polarimeter that took part in the NASA PODEX campaign in 2013, and applications of HARP/PACS science to climate research. The HARP CubeSat will launch in August 2017 for a mission lifetime of up to one year. The inclined orbit of HARP CubeSat will allow for co-incident measurements over AERONET ground stations and under NASA EOS satellites for both land and ocean targets.

10. Alexandra St. Pé

Geography and Environmental Systems

Atmospheric Physics and Policy Uncertainties Reinforcing Offshore Wind Turbine Underperformance

Anthropogenic climate change decarbonization of the electricity sector is the largest single source of global greenhouse gas emissions. Offshore wind (OSW) power provides an enormous, yet mostly untapped electricity resource, with 90 percent of the ~12 GW installed capacity concentrated in a relatively small geographic region of Northern Europe. With steel-in-the-water for the first U.S. offshore wind farm complete in 2016, the nation is poised to advance the OSW market, with a vision to significantly ramp up its generation from 30 MW to 86 GW by 2050, contributing to 14 percent of projected electricity demand in coastal and Great Lakes states. However, despite the value and opportunity for OSW power, significant advancement in lowering costs and scaling up generation lags in part from a reoccurring industry challenge of known as Wind Farm Underperformance Bias (WFUB), which describes the chronic overestimate in a wind farm's preconstruction energy yield. The benefits of mitigating OSW preconstruction energy could contribute to more optimal wind plant designs, increased economic viability, and accelerate the cost-competitiveness of clean OSW power generation. To help mitigate future WFUB in the nation's nascent OSW industry, this research adopts an interdisciplinary approach to identify entwined science and policy challenges that unintentionally reinforce high pre-construction energy yield uncertainty. Using Doppler wind lidar and other remote sensing measurements collected in a coastal environment, a novel empirical method is introduced to classify average vertical wind speed profile (VWP) 'shapes' (e.g. wind turbine inflow) based on goodness-of-fit to several mathematical expressions and relative maxima and minima criteria. Once turbine rotor-layer winds are classified, relationships with broader atmospheric drivers are assessed. Results demonstrate local meteorological features, such as coastal Low Level Jets, Internal Boundary Layers and coastal upwelling, contribute to unexpected OSW resource conditions during the summer season in Maryland's offshore wind energy area. Further,

summertime classified rotor-layer VWP shapes contribute to turbine available power uncertainty; between of 2-11 percent depending on VWP shape. To quantify the impact of classified rotor-layer VWP shapes on actual turbine performance and the contribution of current turbine available power estimation techniques to WFUB (e.g. preconstruction energy yield overestimate vs. underestimate), a coastal wind turbine's power data is analyzed. Finally, given the paramount role of policy in OSW development, uncharted science-informed policy opportunities to 'adjust sails' and help the industry further mitigate future WFUB, develop the most economically efficient OSW projects, and incentivize OSW power value rather than volume are addressed.

11. Aayush Sharma
Engineering Management

I will touch base on key topics of Project Management like: Cost, Scope, Schedule(Time), Quality, Stakeholders and Communication. I would also discuss its importance in different industries be it be Healthcare, IT, Education or others. I work for a non-profit in DC as a Business Systems Analyst/Project Manager and we implement the best practices of Project Management in different projects. My main reason for participation is to spread a word about this field and how important it is. My topic will not only cover the key concepts of Project Management but also how soft skills play a vital role be it negotiation, behavioral studies, psychology etc.

12. Robert Burton
Environmental Engineering
Analysis of Low Cost Particulate Matter Sensors for Asthma Research

Asthma is a prevalent chronic respiratory ailment which affects 7.1 million children and 25.7 million adults in the United States. Asthma is aggravated by environmental and physiological factors. This research contributes to the creation of a wearable asthma monitoring system by developing a low-cost, low-power particulate matter sensor. Particulate matter includes solid and liquid particles suspended in the air, such as, pollen, dust, dander, and smoke. Particulate matter is known to aggravate asthma. The particulate matter sensor will aid in the determination of the triggers for asthma by allowing for more accurate determination of particle concentration, size, and type. This project investigated the response of the Shinyei PPD42NJ particle sensor. The particle sensor uses a process known as nephelometry, light scattering, to measure the particulate concentration. The sensor was characterized for varying particle types and sizes, including sodium chloride, polystyrene latex microspheres, and incense smoke. Improvements to the sensor by increasing the airflow rate and lowering the threshold of detection were investigated.

13. Stephanie Smith
Historical Studies
Tecumseh and The Canadian Bicentennial of the War of 1812

I will discuss the Canadian Commemoration of the War of 1812 and the irony of featuring Tecumseh as one of the Canadian heroes in the interpretive tableau of the commemoration. The irony stems from the tragic history of the relationship between the Canadian government and the First Nations. This topic fills in a gap discussing the 2012 commemorations and how

Tecumseh is celebrated and remembered.

14. Mary Keenan

Physics

AGN Unification through Radio Spectral Analysis

Active Galactic Nuclei (AGN), powered by a supermassive black hole (SMBH), are among the most energetic phenomena in the universe. They can emit radiation throughout the entire electromagnetic spectrum. Radio- loud AGN have large scale jets on either side of the SMBH. These jets cause material to propagate away from the SMBH and into radio-emitting lobes. The two major components of the low-frequency spectral energy distribution (SED) for these AGN are the lobe emission and the jet emission. The jet emission is relativistically beamed along the jet axis, which cause it to be highly affected by the orientation of the jets. The extended emission, however, emits isotopically, and so is independent of the jet orientation. This extended emission can be separated from the rest of the spectrum for a time-integrated measurement of the power of the source. The jet emission can then be analyzed to calculate various quantities that tell us more about the synchrotron emission that comes from the jet. Current AGN unification models characterize sources based on their morphology, which can lead to an unclear distinction in some cases. Meyer et al. (2011) introduces the "Blazar Envelope," which characterizes the sources based on having either strong or weak jets, which clarifies the distinction between AGN classes. An interactive python program is being made to decompose these spectra faster and more efficiently, so that thousands of AGN spectra can be processed, and can be used to revisit the "Blazar Sequence" and to look further into population statistics for these sources.

15. Mirelis Santos Cancel

Chemistry

Collagen Membranes with Ribonuclease Inhibitors for Long-Term Stability of Electrochemical, Aptamer-Based Sensors Employing RNA

Electrochemical aptamer-based (E-AB) sensors offer advantageous analytical detection abilities on account of their rapid response time (sec to min), specificity to a target, and selectivity to function in complex media. Ribonucleic acid (RNA) aptamers employed in this class of sensor offer favorable binding characteristics resulting from the ability of RNA to form stable tertiary folds aided by long-range intermolecular interactions. As a result, RNA aptamers can fold into more complex three-dimensional structures than their DNA counterparts, and consequently, exhibit better binding ability to target analytes. Unfortunately, RNA aptamers are susceptible to degradation by nucleases, and for this reason, RNA-based sensors are scarce or require significant sample pretreatment before use in clinically-relevant media. Here, we combine the usefulness of a collagen I hydrogel membrane with entrapped ribonuclease inhibitors (RI) to protect RNA E-AB sensors from endogenous nucleases in complex media. More specifically, the biocompatibility of the naturally polymerized hydrogel with encapsulated RI promotes the protection of an aminoglycoside-binding RNA E-AB sensor up to 6 hours; enabling full sensor function in nuclease-rich environments (undiluted serum) without the need for prior sample preparation or oligonucleotide modification. The use of collagen as a biocompatible membrane represents a general approach to compatibly interface E-AB sensors with complex biological samples.

16. **Adam Meares**
Organic Chemistry

Hydroporphyrins, such as bacteriochlorins, have been shown to possess excellent properties for a variety of biological applications such as fluorescence imaging, photodynamic therapy and fluorescence guided surgery. These properties include deep red to near infrared absorption and emission, sharp emission bands, and tunability of absorption and emission wavelengths. Perhaps the largest problem, from an imaging perspective, is the small Stokes Shift that ultimately results in poor image resolution due to scattered light from the excitation source interfering with the light emitted from hydroporphyrin fluorophore. To improve this, energy transfer arrays can be prepared with another species acting as energy donor to bacteriochlorin, and giving a much larger pseudo-Stokes Shift. BODIPY can be broadly tuned such that it can absorb across the visible spectrum, and within the biological window (650-900 nm), and we have previously demonstrated that unmodified BODIPY can serve as a suitable energy donor to bacteriochlorin. Herein, we prepared a series of BODIPY-bacteriochlorin dyads, with novel BODIPY energy donors, with distinct absorption maxima centered at approximately 500, 590 and 670 nm, to determine both the overall fluorescence quantum yields, and the efficiency of energy transfer (ETE) when. Photophysical measurements indicate that in nonpolar solvents quantum yields are essentially identical to that of the parent bacteriochlorin monomer, and ETE approaches unity, while properties are significantly quenched in more polar environments.

17. **Michael Zhang**
Chemical Engineering

Cancer immunotherapy, the leveraging of one's immune system to combat cancer, is a field of medicine that is gaining momentum toward clinical use. One approach in cancer immunotherapy is adoptive cell transfer (ACT), which is the manipulation and expansion of immune cells harvested from the patient, and then re-infusing these fully trained cells back into the patient. Despite studies suggesting ACT as a promising cure for diseases, the laborious process of cell manipulation has made implementing ACT challenging in the clinic. To address this, we have engineered molecules that readily couple to immune cells by utilizing the biological properties of cells, so that these immune cells carry drugs that further promote therapeutic outcomes once the cells are re-infused into the patient. To achieve this cell coupling, these drug molecules are constructed by conjugating known immune-stimulating molecules to lipid-based tails, forming stable composite molecules that can bind with lipid-based cell membranes and promote cellular immune function. Using this plug-and-play approach with a variety of drugs in cells in a petri dish, we show that our composite molecules rapidly insert into B- and T-cell plasma membranes, functionalizing these immune cells to 1) efficiently present pathogens to T-cells for cell-based vaccine applications, 2) activate immune cells by presenting danger signals, and 3) promote expansion/function of tumor-specific T-cells toward improving therapeutic efficacy.

18. **Muhammad Mahbubur Rahman**
Computer Science
Understanding the Logical and Semantic Structure of Large Documents

Up-to-the-minute language understanding approaches are mostly focused on small documents such as newswire articles, blog posts, product reviews and discussion forum entries. Understanding and extracting information from large documents such as legal documents, reports, proposals and research articles is still a challenging task. The reason behind this

challenge is that the documents may be multi-themed, complex and cover diverse topics. As a result, the content in the whole document may have different structures and formats. Furthermore, the information is expressed in different forms such as paragraphs of text, headers, data forms, tables, images, mathematical equations, lists or a nested combination of these structures. Semantic organization of sections and subsections of documents across all vertical domains are not same. Identifying a document's logical sections and organizing them into a standard structure to understand the semantic structure of a document will not only help many information extraction applications, but also enable users to quickly navigate to sections of interest. We intend to develop a framework that can analyze a large document and can provide a view, which helps humans to know where particular information is in that document. The framework will navigate you to the sections that describe the policies in the given report. In a nutshell, we aim to automatically identify and classify semantic sections of documents and assign human-understandable and consistent labels to similar sections across documents. Understanding document' structure will significantly benefit and inform a variety of applications such as information extraction and retrieval, document categorization and clustering, document summarization, fact and relation extraction, text analysis and question answering. It will help to extract different important which can be directly useful to other text analysis tasks. Humans are often interested in reading specific sections of a large document and hence will find semantically labeled sections very useful. It will help human to simplify their reading operations as much as possible and save their valuable time.

19. Kiranmayi Prakash Mangalgiri

Environmental Engineering

Poultry Litter Dissolved Organic Matter: PARAFAC Analysis and Role in Photolysis of Antibiotics

Poultry is the most consumed meat in the United States, and more than 90% of the poultry is produced in concentrated animal feeding operations. The intensive farming of poultry has been associated with the introduction of antibiotics, hormones, nutrients, and pathogens to the environment, ultimately affecting water quality. This study focused on the characterization of poultry litter-derived dissolved organic matter (DOM), and its effects on the photolytic fate of contaminants of emerging concern. Briefly, a four-component parallel factor analysis (PARAFAC) model was developed to characterize DOM extracted from poultry litter, using a dataset consisting of fluorescence excitation-emission matrices from 291 treated and untreated samples. The transformation of microbial and terrestrial humic-like PARAFAC components during irradiation at 310-410 was faster than that of tryptophan-like component, reflective of their respective light absorbance; the tyrosine-like component was fairly recalcitrant. The outcomes of the PARAFAC study were used to examine the role of poultry litter-derived DOM on the photodegradation of four antibiotics (i.e., chlortetracycline, ciprofloxacin, roxarsone, and sulfamethoxazole). The fluence-based, pseudo-first-order rate constants for direct photolysis of antibiotics were determined in deionized water (buffered at pH 6.8), and they ranged from 1.8×10-7 to 1.0×10-3 cm2 mJ-1. Antibiotic solutions were spiked with DOM at agriculturally-relevant concentrations (0 – 140 mg C/L) and irradiated at 310 – 410 nm. The observed rate constant for photodegradation of antibiotics in the presence of DOM was modeled to deconvolute the role of reactive species, including 3DOM*, $HO^{\cdot}$, and 1O2. Suwannee River natural organic matter was used as a surrogate DOM standard. The reactivity of each antibiotic with reactive species played a significant role in overall degradation trends. Screening and scavenging of intermediate species inhibited photolysis of ciprofloxacin. The degradation of chlortetracycline, roxarsone, and sulfamethoxazole showed varying degrees of sensitization due

to 3DOM* and 1O2. The source and concentration of DOM affected the steady state concentrations of reactive species and, therefore, the overall photodegradation trends of antibiotics. These results demonstrate that photolysis of antibiotics in agriculturally-impacted matrices occurs despite high concentrations of animal-derived DOM, and that agricultural runoff may severely impact the photolytic fate of contaminants of emerging concern in surface water.

20. Mamatha Hopanna

Environmental Engineering

Photochemical Behavior of Organo-selenium and -tin Compounds and Their Carbon Analogs Under Simulated Solar Irradiance

Unique physicochemical properties of organometallics have resulted in widespread applicability in biomedical, agricultural, and electrical fields. These compounds pose a distinct environmental concern from both the organic molecules and the base metals. In this study, we mapped apparent molar extinction coefficients for 190-500 nm across a pH range of 2-12 for two classes of organometallics, namely organo-selenium and -tin, and their respective carbon analogs. Gaussian functions were used to deconvolute the continuous UV-visible absorbance spectra into individual bands. Ebselen (EBS) and its carbon analog 2-phenyl-3H-isoindol-1-one (C-EBS) demonstrated high absorbance between 230 and 260 nm. The presence of selenium suppressed absorbance below 300 nm, and extended the absorptivity range to 360 nm. A solar simulator was employed to investigated the influence of solution pH and dissolved organic matter (DOM) on the photodegradation kinetics of select organometallics and carbon analogs. The pseudo-first-order rate constant for EBS in phosphate-buffered deionized water was 1.2×10-4 s-1 at pH 4. The addition of 5 mg C/L of DOM caused the apparent rate constant to increase to 4.5×10-4 s-1. On the contrary, C-EBS did not exhibit any significant transformation when irradiated under similar experimental conditions, indicating that the presence of metal atoms in organometallic molecules plays a key role in their photolytic fate.

21. Nopondo N. Esemoto

Chemistry

The ability of hydroporphyrins to generate reactive oxygen species (ROS), and absorb and emit light in the optical therapeutic window (650-900 nm) makes them extremely attractive as fluorescence agents and singlet oxygen photosensitizers. We recently became interested in developing new efficient singlet oxygen photosensitizers and fluorescence probes. We hypothesized that metalated hydroporphyrins will possess improved photophysical properties such as increased singlet oxygen generation and absorb and emit in the optical therapeutic window. In our current study we for the first time synthesized several metalated palladium and platinum hydroporphyrin metal complexes and determined their basic photophysical properties (fluorescence, lifetime and singlet oxygen generation). By means of fluorescence quantum yield measurements; we observed that our metalated hydroporphyrins exhibit decreased fluorescence with solvent polarity dependence. Similarly by direct observation of the singlet oxygen luminescence we observed an increased singlet oxygen quantum yields of these metal complexes. These results represent a promising platform for developing effective singlet oxygen photosensitizers for applications such as photodynamic therapy. Ultimately our goal develops improved photosensitizers for PDT and target-selective imaging agents, which can be selectively activated.

22. Utsav Shashvatt

Environmental Engineering

Development of a Phosphorus Extraction and Recovery System (PEARS) to Recover Phosphorus from Poultry Litter

In the Delmarva Peninsula, over 600 million broilers are produced each year, generating over a million tons of poultry litter. To limit the impacts of nutrient-laden poultry litter on the Chesapeake Bay, Maryland enacted the Phosphorus Management Tool, which prohibits farmers from applying poultry litter to certain agricultural fields. To address these challenges, we have developed an innovative technology called Phosphorus Extraction and Recovery System (PEARS). The specific objectives of this study were to (1) investigate optimal conditions for P(V) extraction and recovery from the poultry litter and (2) preferentially precipitate struvite and potassium struvite. The PEARS process involves bubbling CO2 gas and adding strong acid to poultry litter slurries to effectively extract phosphorus (as P(V)), nitrogen (as NH4+/NH3), and potassium (as K+). The optimum pH for nutrient release from poultry litter solids was measured to be 4.5-5.0, providing over 85% extraction of P(V) in less than 10 minutes. Following separation of the poultry litter solids, nutrients are recovered in the form of valuable fertilizers, such as struvite (MgNH4PO4•6H2O) and potassium struvite (MgKPO4•6H2O). Over 95% of the released phosphorus was recovered as struvite by adjusting the solution pH to 8.5-9.0 through air bubbling and NaOH addition; furthermore, a higher precipitation pH (e.g., 10.5-11.0) resulted in greater production of potassium struvite. The purity of the recovered products was improved through addition of ethylenediaminetetraacetic acid (EDTA). EDTA complexed calcium, providing favorable conditions for selective recovery of struvite or potassium struvite. A full extraction and recovery cycle was completed in 40 minutes, indicating a high potential for farm-scale operations that will address the needs of farmers and maintain environmental quality in the Chesapeake Bay.

23. Erica Dasi

Biological Sciences

Optimizing Chlamydomonas reinhardtii to Utilize Butyrate for Wastewater Treatment

Cultivating algae within wastewater is a promising technology for remediating environmental pollutants and creating renewable energies. While most algae can utilize the nitrogen, phosphates, and simple sugars like acetate that are prevalent in wastewater, few can use butyrate, which is also enriched in sewage effluent. This investigation involves genetically engineering the model green alga Chlamydomonas reinhardtii to metabolize butyrate. We predict that expressing the Arabidopsis acyl-activating enzyme 7 (AAE7) in C. reinhardtii will be sufficient to complete the pathway for butyrate metabolism, permitting this alga to grow on this substrate while removing it from wastewater. AAE7 was cloned into a plasmid that was integrated into the C. reinhardtii genome. AAE7 protein expression was evaluated by western blot in a transformant that had taken up the plasmid. We observed AAE7 protein in the transgenic C. reinhardtii, suggesting the enzyme had been expressed. Future directions of this work involve performing growth studies to evaluate whether the isolate can use butyrate as a sole nutrient source.

24. Brian Cawrse

Chemistry

Antiproliferative Activity of N-substituted Pyrrolo[3,2-d]pyrimidines and Their Potential Use as Therapeutic Agents.

Modification of purine bases to produce pyrrolo[3,2-d]pyrimidines has historically produced compounds with profound anti-cancer effects. Presented herein is a structure-activity relationship study with a series of modifications at both the pyrimidine and pyrrole. These modifications have resulted in a series of compounds with good activity against a wide range of cancer cell lines. The compounds displayed EC50 values between 4 nM-14 μM, with the best activity against pancreatic cancer and leukemia. Mouse studies on the most active compounds showed a maximum tolerated dose (MTD) of at least 10 mg/kg. Synthesis of a prodrug of the most active compound allowed the MTD to rise to at least 40 mg/kg, representing a significant decrease in toxicity. Pharmacokinetic studies confirm that the prodrug is converted to the active metabolite and that this happens within 30 minutes of injection into mice. Interestingly, the prodrug form also shows activity against triple negative breast cancer, and is currently undergoing studies in mice. Taken together, the chemical and biological data indicates that these pyrrolopyrimidines act as potent anti-cancer agents across a broad spectrum of cancer lines, and that the associated toxicity can be mediated by addition of prodrug moieties that allow the compound to be administered and metabolized to their active forms in vivo.

25. Yangling Zhou

Mechanical Engineering

Development of an Advanced Nonlinear Rotation Free Plate Element

In Finite Element applications, the use of a classical plate elements which contain displacements and rotations as Degree of Freedoms (DOFs) is known not to be suitable for applications involving solid-fluids interaction analysis. Therefore, a Rotation Free (RF) plate element dealing with the bending effects of thin plates of membranes needs to be developed. By combining a non-linear plane stress element along with its non-linear RF plate element counterpart, one can form a non-linear RF shell element which describes the stretching and bending effects of thin plates and shells under large deformation conditions. Thus, such an element can be used to study the movement and deformation of Red Blood Cells whose membrane constitutive properties are non-linear. In this study, two advanced nonlinear RF plate elements are formulated based on the Lagrangian method, one using the cell centered scheme and the other one using node centered scheme. The finite volume method is applied by taking the integral of the curvatures to avoid rotations in the finite element equilibrium equations. Geometrical nonlinearity and material nonlinearity are considered during the derivation of these two elements. For nonlinear material models, the Neo-Hooken and Mooney-Rivlin materials which can be used in modeling RBC membranes are adopted. To solve the nonlinear system, the incremental method cooperating with the Newton method is implemented. Finally, relevant case studies aimed at validating these two advanced RF nonlinear plate elements under large deformation and large strain conditions are carried out. The results show that the newly developed elements have high accuracy by comparing to the analytical solutions or the numerical results from the commercial package ABAQUS.

26. Alexander Winton

Chemistry

Artificial Peptides for the Improved Synthesis and Performance of Lithium Ion Battery Electrodes

This research project seeks to improve the energy density, cycle life, and power performance of lithium ion battery electrodes through a bio-inspired approach. Artificial evolution through phage display has been used to identify peptides with specific binding affinities for electrode component materials. Characterization of these binding peptide domains will enable rational design of multifunctional polypeptides which may be utilized as a bio-tethering component in electrodes, thereby reducing currently required binder and conductive additive masses. These peptide domains will also be employed to template the synthesis of desired active materials by means of a biomimetic approach. Preliminary data demonstrated a 12 amino acid peptide binding domain, expressed on a phage mutant, improves the virus' binding affinity by 7-fold compared to a wildtype virus lacking the peptide domain. Initial use of the identified peptide domain in the synthesis of Lithium Titanate Oxide (an anode material), demonstrated a unique effect on the electrochemical performance (multiple redox plateaus) of the material compared with a template free synthesis.

27. Estela C. Monge

Biological Sciences

Functional Characterization of the Glycoside Hydrolase Family 18 Chitinases in the Saprophytic Bacterium Cellvibrio japonicus

Understanding the strategies used by bacteria to degrade recalcitrant polysaccharides constitutes an invaluable tool for biotechnological applications. Bacteria are known as major mediators of polysaccharide degradation as is the case for chitin the second most abundant polysaccharide on earth. However, the complete mechanism used by chitinolytic organisms to degrade chitin is not well understood. Our studies of the lignocellulose degrading bacterium, Cellvibrio japonicus, demonstrate it can also degrade chitin but few studies have been conducted on the capacity of this bacterium to degrade chitin. Previous sequence analysis of the C. japonicus genome has indicated the presence of four Glycoside Hydrolase Family 18 chitinases but the physiological roles of each of this predicted chitinases were unclear. Here, we determine the physiological roles of the Family GH18 chitinases in the degradation of different forms of chitin. Through a combination of transcriptomic and genetic approaches, we demonstrated that Chi18D is essential for the degradation of chitin substrates. In addition, our mutational studies suggest that the chi18B and chi18C gene products are working together, as we observed more severe growth defects from the double deletion mutant than each single mutant. Overall, our work suggests complex regulation of the chitin degradation machinery of C. japonicus and non-redundant physiological functions.

28. Heather Mutchie

Gerontology

Detecting Cognitive Impairment after Hip Fracture to Predict Dementia-Related Cause of Death

Hip fracture patients are known to have high rates of pre-existing dementia (20%) and post-operative delirium (35-61%). Previous studies suggests that dementia and delirium in this population are correlated with mortality. The purpose of this study was to examine the predictive value of Modified Mini-Mental State Examination (3MS) and chart diagnoses at

discharge on dementia-related cause of death (DR-COD) in a cohort of hip fracture patients. Hospital charts, cognitive testing within 15 days of admission, and National Death Index reports from the Baltimore Hip Studies 7th cohort (2006-2011) were collected in 339 (171 women, 168 men) subjects. The 204 subjects that died before Dec. 31st, 2014 were analyzed using odds (OR) of DR-COD, which included codes of Alzheimer's disease or dementia as any primary or contributing cause of death. Predictors included dementia or delirium diagnosis in hospital chart, and age/education-corrected 3MS<78. DR-COD was found in 47 (29.7%) deceased participants, 13.7% (n=28) identified as cognitively impaired by both 3MS and chart; 13.7% (n=28) by 3MS alone, 12.8% (n=26) by chart alone; and 58.33% (n=119) were not cognitively impaired. Those with cognitive impairment by both 3MS and hospital chart had a 11.6 greater odds of DR-COD (p=<.0001, 95%CI: 4.52-29.71) than those identified by neither (ref=1). Odds of DR-COD among those identified by 3MS alone were 5.12 (95%CI: 2.54-10.30); 4.313 by hospital chart alone (95%CI: 2.15-8.66). 3MS detected impairment in 19.2% of patients who later died of DR-COD that were otherwise missed using only hospital charts.

29. Maraki Negesse

Biological Sciences

Anoxia-Mediated Regulation of Microtubule Dynamics

Entering a hypometabolic stage is a survival means adopted by many organisms when faced with harsh conditions, such as low oxygen levels. Despite the importance of this physiological adaptation, little is understood about the pathways that trigger it. The goal of my research project has been to characterize this process in the zebrafish. Zebrafish embryos can survive up to 50 hours in anoxia (zero oxygen) by arresting development, a mechanism that conserves ATP and contributes to hypometabolism. During zebrafish epiboly, developmental arrest is achieved by pausing the spread of the blastoderm over the yolk. Epiboly is thought to be driven by the remodeling of the yolk microtubule network, which provides a pulling force on the blastoderm. Indeed, drugs that either stabilize or destabilize microtubules can cause a delay or blockage of epiboly, raising the possibility that signaling pathways that promote anoxia-induced arrest during epiboly may impinge upon the microtubule cytoskeleton. Based on these observations, I hypothesized that changes in microtubule stability under anoxia may be a key mechanism driving developmental arrest. To test this hypothesis, I used a transgenic line expressing double cortin-like kinase 2 (dclk2) fused with GFP, which allows indirect visualization of microtubules. 50% epiboly stage zebrafish embryos were subjected to an hour of anoxia or normoxia. Imaging was performed using confocal microscopy. Preliminary data suggest that the anoxia-subjected embryos show some disruption in the network of yolk microtubules compared to normoxic controls. Identifying the different molecules involved might better our understanding of anoxia-mediated arrest.

30. Josey Stevens

Physics

Quantum Information Processing by a Continuous Maxwell Demon

Quantum computing is believed to be fundamentally superior to classical computing; however, quantifying the specific thermodynamic advantage has been elusive. Experimentally motivated, we generalize previous minimal models of discrete demons to continuous state space. To satisfactorily compare the advantages of quantum or classical computation we must quantify the thermodynamic resources requisite for each. Analyzing our model, by numerically solving

the Schrodinger equation, allows one to quantify the thermodynamic resources necessary to process quantum information. By further invoking the semiclassical limit we compare the quantum demon with its classical analogue. Finally, this model also serves as a starting point to study open quantum systems.

31. Saman Nezami

Mechanical Engineering

Leaf Spring Design for a Maintenance Free Vibration Energy Harvester

A successful energy harvester design needs to meet power requirement as well as structural integrity (including durability and cost effectiveness). Even though plenty of researches have been reported on improving the power requirement, very little effort has been made to address the integrity issue since energy harvesting research up to now. To this end, this paper presents design optimization study to enhance integrity while satisfying power generation performance an electromagnetic vibration energy harvester. The harvester is for a maintenance-free power supply for a wireless sensor module which monitors rail bogie axles and bearings. The energy harvester is designed to collect vibration energy on the axles during railroad operations. There are two leaf springs assembled on the both side of the harvester which facilitate the vibration along the direction of the shaft in the middle of device. The current leaf spring design is problematic because of high stress concentration and the corresponding fatigue failure before expected performance life of the device. Our research team realized a durability issue on the leaf spring when the harvester experiences high vibrating impulse loading during railroad operations. The optimization study has been conducted to redesign the shape of the leaf spring and reduce the stress concentration while satisfying the power requirement reflected by vibration amplitude (flexibility) within the frequency range of interest as well as manufacturability. To optimize shape of the spring, geometry of the spring model was parametrically imported in ANSYS APDL considering physical and manufacturing limits. Based on the new design, six parameters were defined as design variables considering manufacturability. SQP algorithm was used to find optimum value of variables using a MATLAB code linked to the ANSYS software. Level of stress was calculated using PSD analysis and amplitude of vibration was evaluated with harmonic analysis. A separate electromagnetic analysis has been done to figure out the required vibrational amplitude. The results of this research showed that the new spring model could reduce the magnitude of stress concentration in the structure of the leaf spring while satisfying required vibration amplitude and natural frequency of the device for energy harvesting. As future work, amount of power generated by the device will be estimated and experimental verification will be performed.

32. Rickesh Patel

Biological Sciences

Navigating the Benthos: Landmark Orientation and Path Integration in a Mantis Shrimp

Stomatopods are predatory marine crustaceans renowned for their ballistic strikes and complex visual systems. These animals commonly inhabit holes and crevices in the benthic substrates of marine environments for use as burrows, where they may reside safely concealed from their predators. However, stomatopods forage at extended distances from these burrows before returning to their homes. This raises the question, how do stomatopods navigate back to their burrows efficiently to limit the risk of predation? Many other central place foragers from a wide taxonomic breadth update their position relative to their point of departure to produce a self-

generated home vector with which to find the point of departure with the greatest economy. This process, termed path integration, is likely to be used by stomatopods as well. Also, piloting, the process by which an animal follows a landmark or chain of landmarks to a goal, is a likely strategy these benthic organisms use in their structurally complex reef environments. To experimentally determine if these mechanisms are employed, Neogonodactylus bredini were placed in featureless circular arenas in a glass roofed greenhouse, with their burrows submerged from view. Foraging paths in the presence and absence of a landmark adjacent to the burrow were recorded. Initial data suggests that return trips in the presence of the landmark are more direct than trips in the landmark's absence. However, the initial direction of the return trips was generally oriented towards the burrow regardless of the presence or absence of the landmark. Furthermore, in the absence of a landmark adjacent to the burrow, N. bredini traveled in its perceived homeward direction a distance approximately equal to the beeline distance to the burrow before initiating a search behavior. These results indicate that N. bredini may use both path integration and piloting to find its burrow.

33. Jong S. Park

Neuroscience and Cognitive Sciences

Role of Lactate-NDRG Signaling in Low Oxygen Tolerance

Low oxygen (O2) partial pressure results in decreased ATP levels via reduction in oxidative phosphorylation – which is most acutely experienced in organs with high metabolic demand. Hence it is not surprising that ischemic injuries cause major morbidity and mortality worldwide. Zebrafish embryos maintain function and homeostasis under low O2 by transitioning into a hypometabolic state, which is manifested by an arrest or a delay in development. Remarkably, zebrafish embryos can survive up to 50 hours in this hypometabolic state in complete absence of O2 (anoxia). Currently, the molecular mechanisms that initiate and maintain the hypometabolic state in zebrafish are unknown. Understanding these molecular mechanisms may reveal potential therapeutic targets for the prevention and treatment of ischemic injuries. We are currently using a multipronged approach to identify molecular mechanisms of hypometabolism in zebrafish embryos. A mass-spectrometry study examining metabolites whose levels change in anoxic conditions revealed a significant increase in the concentration of lactate – a molecule which was recently shown to bind to N-myc downstream-regulated gene (NDRG) to promote angiogenesis and proliferation in hypoxic cancer cells; suggesting a signaling role of lactate in cellular adaptation to low O2. Given these findings, we hypothesize that a lactate mediated signaling via NDRG under low O2 may be present in zebrafish embryos. To test whether lactate functions in an NDRG-dependent manner to promote low O2 tolerance in the zebrafish embryo, we first examined in situ and immunofluorescence data of family members of NDRG1 and 3. In situ and immunofluorescence expression revealed NDRG1 is enriched in the kidney and mucous cells whereas NDRG3 is initially ubiquitously expressed and by 48 hours post fertilization (hpf), is restricted to the retina and nervous system. Next, we tested whether NDRG1 and 3 are sensitive to low O2 using an antibody that recognizes both NDRG proteins using western blot analysis. The analysis revealed a dramatic stabilization of NDRGs in anoxia treated embryos relative to normoxic control embryos. Next, to test the requirement of NDRG1 and 3 for low O2 tolerance, loss of function studies will be performed using NDRG1 and 3 translation blocking morpholinos and CRISPR mutants (in F0 generation). In addition, we will verify lactate binding of NDRG under anoxia using an in vitro binding assay for WT and lactate binding site mutant NDRG protein. If lactate binding in mutant NDRGs is disrupted in in vitro binding assay, lactate insensitive NDRG zebrafish mutants will be generated to examine their

tolerance to low O2 condition. Together, these studies investigate a novel role for lactate as a putative low O2 proximal signal for NDRG1 and 3 that promote low O2 tolerance in zebrafish embryos.

34. Mary Yates

Chemistry

Design, Synthesis, and Biological Evaluation of Flexible Acyclic Nucleoside Analogues Against Human Coronaviruses and Filoviruses

To date, there are no FDA approved treatments or vaccines for diseases caused by coronaviruses (CoVs) or filoviruses. Over the past decade, two deadly human coronaviruses, Severe Acute Respiratory Syndrome CoV (SARS) and Middle East Respiratory Syndrome CoV (MERS), have emerged as lethal pathogens with high mortality rates. Filoviruses, such as the Ebola (EBOV), Sudan (SUDV), and Marburg (MARV) viruses, also represent a severe health threat with mortality rates reaching 90%. With the potential of global reemergence of SARS, as well as the recent outbreaks of MERS, EBOV, and SUDV, it is imperative that a viable and efficient treatment is developed to increase survival rates of these lethal diseases. Nucleoside analogues have long served as the cornerstone for antiviral therapeutics due to their ability to inhibit viral DNA or RNA replication; however, one major issue is the moderately high genetic mutation rate associated with these viruses, which alters the enzymatic binding site and renders the antiviral agents ineffective. One way to potentially overcome drug resistance is to create a more flexible nucleobase scaffold to increase adaptability of the drug once bound within the target enzyme. The Seley-Radtke lab has developed various types of flexible nucleoside analogues, called "fleximers", that have demonstrated the ability to overcome point mutations within the binding site of biologically significant enzymes, as well as to increase interactions in the binding pocket that were unattainable by the parent nucleoside. Preliminary results have shown that several acyclic Flex-analogues of the FDA-approved drug Acyclovir have shown activity against both SARS and MERS in vitro. These findings are groundbreaking since these compounds represent the first nucleosides to exhibit potent activity against SARS and MERS. More recently, studies have uncovered activity against various filoviruses including EBOV, SUDV, and MARV.

35. Brian Carroll

Atmospheric Physics

Observing Storm Precursors Over the Great Plains

Wind is one of the most important components of the Earth-atmosphere system. It facilitates the transport of water vapor, heat, and pollution. Its momentum can feed into storms as well as provide a green energy source. In many parts of the world, phenomena known as "low-level jets" (LLJs) magnify the helpful and harmful effects of wind. A LLJ is defined as a nocturnal lower-tropospheric wind speed maximum. The research presented here will test the current theoretical formulation of LLJs against observational data. Data from a field campaign in the Great Plains region of the United States will be used to examine LLJ moisture transport and storm generation.

36. Ashley Wayne

Mechanical Engineering

Infant Skull Fracture Mechanics in Abusive Head Trauma Versus Accidental Falls

Head injuries are the leading cause of death in infants (Powell et al., 2013). In addition, crying is the most common triggering factor for abusive head trauma and the majority of cases are reported when an infant is 6-8 weeks old (Simonnet et al., 2014). Oftentimes, there are disparities in whether the head injury was caused by inflicted abuse or an accidental fall as skull fracture can occur in both cases. More literature on cranial fracture mechanics can help forensic pathologists determine whether a skull fracture is due to abuse or an accidental fall. A study was conducted to compare the crack length of entrapped infant (2-17 days old) porcine skulls to controlled head drops. However, the majority of abuse cases typically occur when the infant is slightly older and this study did not consider whole body kinematics for force dissipation through the body (Powell et al., 2013). There is also a lack of scientific data on the variability in the causes of the head injury such as distance of fall and the nature of the surface the child falls on. Therefore, it is important to test a range of variables to better understand the mechanical behavior of infant skulls after accidental falls and abuse. The central goal of this proposed study is to compare infant skull fracture mechanics of infants who experience accidental falls and abusive head impacts. Our hypothesis is that the crack length in the skull will be larger in abuse cases compared to accidents.

37. Jared Margulies

Geography and Environmental Systems

Employing Collaborative Photography in the Study Multispecies Encounters: Possibilities and Pitfalls

This presentation will discuss the possibilities and pitfalls of employing collaborative photography as a research method in multispecies political ecology studies. I will reflect on and present results from the process of designing, implementing, and completing a research and advocacy project entitled, “Living with Wildlife in Mangala.” Through this project six participants documented their lives along the fringes of Bandipur Tiger Reserve in Karnataka, India. Through their photographs they ask us to question and debate prescriptive, top-down approaches to wildlife conservation and best management practices for endangered species that largely ignore the socioeconomic realities of the rural poor. I will discuss challenges, mistakes, and future directions in developing participatory photography as a tool in political ecology and in multispecies studies more broadly. I will rely on the results of the Mangala project and in-depth interviews with the participants to raise practical and theoretical considerations for scholars seeking out alternative research methods attuned to questions of environmental justice grounded in emancipatory research practices.

38. Natalie Roberts

Biological Sciences

Validating Video Playback Methods in Darters (Percidae: Etheosomta)

The use of video in behavioral trials has many benefits over the use of live stimuli or artificial models; however, video monitors are not designed for non-human viewers and differences in visual systems can yield misleading results if video stimuli are not perceived in a similar manner as live stimuli. In order to validate the use of video trials for the darter (Percidae: Etheostoma),

conspecific preference trials were conducted with both live stimuli and video stimuli. The results of these test whether both the behavior and magnitude of behavior are comparable between live and video stimuli. Darters are good candidates for use in video trials because their two cone classes absorb maximally around the peak radiance of the green and red monitor phosphors respectively. In addition, when contribution of the blue monitor phosphor is reduced to near zero, live darters and images of darters displayed on monitors are similar in color. Colors corresponding to black, blue, green, and yellow are indistinguishable between the live and monitor stimuli in darter visual space; red coloration, while above the threshold for discrimination, is still considered poorly discriminable. Results show that there is a species-specific response to video stimuli, with one of the two species tested responding towards video stimuli. Future work will aim to determine how video manipulation can become more accessible to a larger number of darter species.

39. Kartikeya Joshi

Biological Science

Role of Ctk1 in Regulating Translational Accuracy by Phosphorylation of uS5

Posttranslational modification of proteins of the translational apparatus is common in many organisms. Enzymes responsible for such modifications have been identified but the physiological functions of many modifications are still unclear. This study aims to use S. cerevisiae as a system to understand the functional implication of phosphorylation of ribosomal protein uS5, a homolog of E. coli Rps5, which has a well-defined function in translational accuracy. uS5 is phosphorylated at serine 238 residue by Ctk1. Using a reporter assay we have confirmed that loss of Ctk1 causes increased errors during translation and this effect could be mediated by phosphorylation of three different serine residues on uS5. Those residues are serine 176, serine 181 and serine 238. We see increased errors when we mutate any of those three residues to alanine. Phosphomimic mutations at those three sites can restore accuracy up to a certain extent. These phenotypes confirm an important role that phosphorylation of these residues play during translational accuracy. By modeling structures of these residues on uS5, we predict that the phopshoserines on these residues could be modulating the structure of the ribosome by interacting with positively charged arginine residues on uS4 and uS0. We are currently investigating these interactions. We also introduce a new reporter system that can be used to measure misreading errors by tRNAGluUUC in addition to the already available Dual luciferase reporter system to measure errors by tRNALysUUU in S. cerevisiae. tRNAGluUUC makes second position Uï,ŸG errors with the two glycine codons GGA and GGG and wobble position Uï,ŸU and Uï,ŸC errors with the two aspartic acid codons GAU and GAC respectively. We have shown that the ribosome is highly efficient in discriminating against most of the near cognate codons, with most errors being as low as 1 in million error per codon.

40. Richard Brewster

Physics

Schrodinger Cat States and Quasiprobability Distributions

The theory of quasiprobability distributions is an essential theory to the field of quantum optics. One such quasiprobability distribution is the Glauber-Sudarshan P-function. The P-function has been shown to exist for all states in the context of distributions, however for non classical states the P-function can be highly singular. In this work we seek to calculate the P-function for a superposition of two coherent states (e.g., a Schrodinger cat state) as well as other non classical

states. We do this using the transformations between the other major quasiprobability distributions. We find that the P-function for these states can be described using a generalization of the Dirac delta function that admits complex arguments.

41. Danielle Schmitt

Chemistry

Spatial Regulation of Enzyme Compartmentalization by Small Molecules in Live Cells

Glycolysis is catalyzed by ten enzymes, producing two moles of pyruvate and two ATP molecules for every one mole of glucose consumed. While much is understood about the process, the spatial compartmentalization of glycolysis in human cells has remained elusive. Recently, we have demonstrated using quantitative live-cell imaging the association of human glycolytic and gluconeogenic enzymes into cytoplasmic clusters in living human cells. Interestingly, lysine acetylation was found to influence the localization of one glycolytic enzyme, human phosphofructokinase I liver-type (PFKL), as well as the multienzyme complex formation. However, specific regulatory mechanisms behind the spatial control of glycolytic enzymes remain elusive. To study the regulation of glycolytic enzyme localization in cells, we have developed a high-content screening assay that reports the promotion of PFKL clustering in a high-throughput fashion. The high-content screen utilizes HeLa Tet-On cells stably expressing PFKL tagged with a monomeric form of enhanced green fluorescent protein (PFKL-EGFP) to visualize the glycolytic multienzyme complex. A pilot screen using the Library of Pharmacologically Active Compounds (LOPAC) identified small molecules that regulate PFKL-EGFP clustering in cells. Accordingly, we hypothesize the compartmentalization of PFKL-EGFP is spatiotemporally regulated by the cell cycle in human cells. As PFKL-EGFP is used as a marker for a glycolytic metabolic complex, we envision that our study will advance our understanding of how the spatial compartmentalization

42. Julie Nyman

Chemistry and Biochemistry

Screening Small Molecule Inhibitors Against the Core Encapsidation Signal of HIV-1 RNA

The core encapsidation signal (CES) of the human immunodefiency virus type I (HIV-1) is required for the efficient packaging of the RNA genome into new virions. Because the CES is highly conserved and is essential for the propagation of the virus, it offers potential as a drug target. Nuclear magnetic resonance (NMR) spectroscopy will be used to characterize the binding between this drug target and small molecule inhibitors. Preliminary NMR data was collected in a 20 mM Tris, pH 7.5, buffer, and the resulting spectra indicated that thirty of the seventy-nine tested inhibitors were binding. Using isothermal titration calorimetry (ITC), the interactions between the CES and small molecule ligands were further probed to elucidate thermodynamic parameters. To see whether these findings were also observed in physiologically relevant conditions, buffers were prepared that contained Tris and combinations of magnesium chloride, potassium chloride and sodium chloride salts. The binding interactions were again tested using NMR and ITC. The previously observed binding interactions were no longer seen, suggesting that salts present in the buffers prevent the binding of certain small molecule inhibitors to the CES RNA. Using additional ITC and NMR, screening of the interactions between the CES RNA and small molecules in physiologically relevant conditions will commence.

43. Mahdad Talebpour
Environmental Engineering

A new nonlinear two-equation Reynolds-averaged Navier-Stokes(RANS) k-omega model is tuned for the simulation of secondary currents in open channels. Secondary currents of the second type are crucial in the sediment transport process in fluvial streams. The complex and mysterious mechanism behind secondary current generation demands extensive research in different configurations. o This study focused on simulating secondary currents caused by bed roughness change. The new model tuned and implemented in this study produces almost 90% accurate results while it is computationally cheap with its RANS based structure. The k-omega formulation gives the ability to implement roughness through a wall function first introduced by Wilcox(1993) and modified by Hellsten(2004). The model and the wall function was capable to accurately produce the results of a well-established experimental data. o The proposed tuning function for implementation of roughness in simulation of secondary flows provides an excellent framework for investigation of secondary currents to evaluate the mechanism behind its generation.

44. Josh Moskowitz
Chemistry

Fluorophore induced plasmonic current is generated when an excited fluorophore in near proximity to a metal nanoparticle film induces a plasmon resonance, which generates current. In this work we describe the effect of different metals, and nanoparticle film continuity (i.e. non-continuous and semi-continuous) on the magnitude of the induced plasmonic current, in an attempt to understand and optimize the signal response in the presence of a fluorescent molecule (i.e. near-field dipole). It is found that semicontinuous metal nanoparticle films provide for increased current generation as compared to non-continuous films. It is also observed that silver nanoparticle films allow for a greater current generation compared to the other metals investigated. Additionally, the effect of varied concentrations of salt are investigated in order to understand how fluorophore induced plasmonic current can be applied in the detection of biological species. It is observed that fluorophore in an excess of salt provides a significantly greater signal compared to the salt alone. Finally, the role of an electron donor and electron acceptor in current generation is investigated in order to better understand plasmonic electricity and its applications. These results broaden our understanding of fluorophore induced plasmonic current generation, with potential application in the detection of biological species, without the need for detectors such as photomultiplier tubes, avalanche photodiodes, and linear arrays.

45. Marwa El-Sayed
Chemical Engineering
An Online Method to Characterize Reversibility of aqSOA

A new method is presented for the characterization of the reversible/irreversible nature of secondary organic aerosol formed in aerosol water (aqSOA). The relative contribution of reversible and irreversible uptake processes is a major unknown in our understanding of atmospheric aqSOA formation. The method utilizes simultaneous measurements of water soluble organic carbon in the particle (WSOCp) and gaseous (WSOCg) phases as surrogates for SOA and for secondary oxygenated organic gases, respectively. The central feature of this

measurement approach is the behavior of WSOCp under conditions of drying, the WSOCp sample is alternated between an unperturbed ambient channel (WSOCp) and a dried channel in which the air sample passes through a silica gel diffusion dryer (WSOCp,dry). The enhancement in SOA formation due to aqSOA is inferred based on the enhancement in the fraction of the total WSOC in the particle phase, Fp, as a function of RH. A decrease in the WSOCp concentration through the dried channel indicates the evaporation of SOA due to water evaporation and hence, reversible aqSOA. On the other hand, irreversible aqSOA is inferred if no statistically significant difference is observed in the WSOCp concentrations through the two channels. The completely automated system is able to run for weeks with minimal intervention. A single WSOCp- WSOCp,dry - WSOCg measurement cycle is completed in 14 min, allowing for the characterization of dynamic changes in the factors influencing reversible/irreversible uptake processes. Measures were undertaken to validate the method, minimize particle losses within the system and ensure reliable measurements across diverse ambient conditions.

46. Tonya Santaus

Chemistry

Microwave Cellular Lysis and DNA Fragmentation of Listeria Monocytogenes and Vibrio Cholera using Metal Triangle Structures

Vibrio cholerae and Listeria monocytogenes are water and food-borne pathogens that result in high mortality rates for those infected. Cholera is primarily found in places with poor sanitary conditions and water conditions. According to the Center for Disease Control, cholera infects 3-5 million people annually. Listeria can be found in soil and food processing plants making it difficult to isolate to one contamination site. Immunocompromised, elderly, and pregnant women and the fetus are at a higher risk for severe infection. Listeria has a mortality rate between 18% and 30%. To date, the sample preparation is the bottleneck to detection of pathogens like Listeria and Cholera. In our lab, we have designed a rapid and low-cost method to lyse bacterial cells and fragment genomic DNA in one step. This method utilizes a standard microwave equipped with a sample holder and a microscope slide with disjointed metal bow-tie structures and an isolator for sample containment. The metal bow-ties focus the microwaves to the center of the bow-tie resulting in an increase in temperature and energy at the apexes. This substantial increase in temperature and energy rapidly lyses the bacterial cells and fragment the DNA. This sample post-microwave irradiation (lysate) can then be used on various detection platforms such as Polymerase Chain Reaction (PCR) and Microwave-Accelerated Metal-Enhanced Fluorescence (MAMEF) assays. Currently the work focuses on the optimization of the metal bow-ties to allow for the optimal cellular lysis and DNA fragmentation of Listeria and Cholera. Gold is the standard metal for the bow-tie structure, but other metals such as silver, copper, and aluminum are being analyzed. Other work such as evaluating our method to conventional methods such as the boiling method are underway. In this poster I demonstrate that other metals like silver and copper have the potential for microwave focusing for the goal of complete cellular lysis and DNA fragmentation of Listeria monocytogenes and Vibrio cholerae.

47. Rachael Knoblauch

Chemistry

Functionalizing Carbon Nanodots: An Exploration of Halogenation and Silver Metal Deposition for Photoluminescence Tuning

Carbon nanodots are fluorescent particles studied for their distinct photoluminescent properties

and photostability. With a diverse distribution of sizes, carbon nanodots have shown broad excitation wavelength dependent fluorescence emission in the visible range. Past studies within the Geddes lab have also shown a unique temperature dependent behavior of these nanodots. Although other methods for synthesizing nanodots have been established, a combustion based strategy is utilized. This strategy permits higher quantum yields than previously reported methods, and allows collection in multiple solvents. Nanodots have been functionalized in a variety of ways to achieve different luminescent properties. The goal of this study is twofold, and involves the separate functionalization of the nanodots with bromine, iodine, and elemental silver. Firstly, both combustion and traditional organic synthetic strategies are tested to functionalize the nanodots with bromine and iodine. The addition of these elements to the dots have shown phosphorescent character. Studies into different functionalization strategies will establish the optimal method to achieve desired phosphorescent lifetimes and quantum yields. Ultimately these nanodots will be used in singlet oxygen generation studies. Previous work has determined brominated dots to produce low amounts of singlet oxygen; however, iodinated forms have not yet been tested. Elemental silver deposition is also under investigation. Metal enhanced fluorescence (MEF) is of keen interest to the Geddes lab, and has been shown to increase the fluorescence signal of carbon nanodots when analyzed in silver nanoparticle coated well plates. By utilizing light-induced reduction of silver ion it is hypothesized that elemental silver will be deposited on the carbon dots, allowing MEF of the nanodots to occur in traditional plates or cuvettes, independent of external silvered sources. Preliminary experiments have shown conditional success, encouraging further experiments to optimize the MEF output of silvered dots. It is hypothesized that heavy metal functionalization and silver deposition strategies can intersect to generate silver-coated brominated and iodinated nanodots. Should this hypothesis yield success, it is possible that even higher yields of singlet oxygen could be achieved.

48. Miji Jeon
Chemistry and Biochemistry

Glycolytic enzymes have been suggested to form multienzyme complexes in a variety of organisms. However, there is a lack of understanding of fundamental mechanisms that regulate the direction of glucose flux at the single cell level. Quantitative live cell imagining with fluorescently tagged human liver type phosphofructokinase 1 (PFKL) has allowed us to identify a variety of sizes of cytosolic enzyme clusters in human breast carcinoma Hs578T cells. Importantly, cell-based metabolic flux assays unveil the cluster size-dependent metabolic functions of PFKL clusters at single cell levels. Collectively, we propose that the varying sizes of this enzyme assembly represent various metabolic functions to guide the direction of glucose-mediated carbon flux in the cell.

49. Zheng Zheng
Chemistry

A deeper understanding of how changing the charge and hydrophobic properties of nanoparticle coatings can predict their behavior when interacting with cell membranes will be essential for guiding future nanoparticle design. This study uses gold nanoparticles (GNPs) that have been coated with synthetic mimics of antimicrobial peptides (SMAMPs), a novel poly-[oxo-norbornene] based nanoparticle coating. SMAMPs synthesized with different ratios of amine to butyl functionalizations were coated onto 25-30 nm GNPs and tested using a liposome lysis

assay. Measuring the increase in fluorescence of a solution of fluorescently quenched liposomes after incubation with SMAMPs coated gold nanoparticles showed in increase in lysis efficiency as the amine to butyl ratio of the coating increased. It was shown that there was a positive correlation between the charge of the nanoparticle coating as measured by zeta potential and their lysis efficiency. In addition, the counterintuitive nature of increasing the amine to butyl ratio and the negative correlation with their zeta potential is explored through the use of X-ray photoelectron spectroscopy (XPS) and Thermogravimetric analysis (TGA).

50. James C. Kitchin
Public Policy

Many rustbelt cities are currently trying to attract new immigrant populations by creating immigrant-friendly policy regimes. There is very little literature on the effectiveness of these local immigration policies and what does exist lacks consensus. Furthermore, the literature on these local efforts does not establish an adequate context through which to analyze them. The purpose of this work is to synthesize the literature on urban studies and immigration to develop the proper context through which to view this nascent policy area. The objective of this project is to develop a theoretical lens that will aid city officials in the rustbelt in deciding whether to adopt or expand a pro-immigrant policy regime as a strategy to grow their cities and to aid in interpreting the results of both current and emerging studies that evaluate the effectiveness of these policies. Also, to help to direct future studies on the effectiveness of local immigration policies. The sample is the current literature on (a) the historical trends causing rust belt cities to have experienced population loss since 1950, (b) how immigrants and immigration policy have historically interacted with U.S. Cities, (c) the current trends in immigrant settlement and immigration policy. The design is to synthesize the work in these areas in one place, which to the best of my knowledge has not yet been done, to build the proper context to understand this emerging policy area. Understanding the proper context gives reason to be cautiously optimistic that immigrant-friendly policy regimes can help to rebuild the population of rustbelt cities. These cities should continue to explore public policies that make them immigrant friendly as a way of addressing their population issues. Furthermore, this context provides insights into what mechanisms might be at work. For example, any success might be due to the interaction of these policy regimes with an already-thriving service sector. On the other hand, a lack of success might be due to competition with surrounding suburbs as opposed to other central cities. The metropolitan context of each city, whether the surrounding counties and municipalities have also adopted immigrant-friendly policy regimes, is something that studies aimed at evaluating the effectiveness of these policies should account for.

51. Jonathan Graf
Applied Mathematics
Performance Analysis and Numerical Method Tuning for an Elliptic Test Problem on the Intel Xeon Phi — KNL

Our problem of interest is a system of non-linear, coupled, time-dependent PDEs modeling calcium induced calcium release (CICR) in a heart cell. To study the behaviors requires large numbers of parameter studies run to long final times. This demands highly efficient numerical methods, tuning of the numerical method parameters, and the use of modern parallel architectures. This is particularly challenging as the model includes thousands of point sources at which calcium can be released over the three dimensional domain. We examine the interplay

between the numerical methods within a method of lines approach with FEM and FVM through an examination of the time stepping behavior. The parallel implementation of this method in C with MPI and OpenMP is matrix-free and has demonstrated speedup on modern CPUs.

52. Mary Donohue

Biological Sciences

"Eyes" in the Backs of Their Heads: Cerebral Opsin Expression in Mantis Shrimp

Animals have light detectors in tissues outside of eyes, called extraocular photoreceptors, for non-visual functions like circadian photoentrainment and photolocomotory responses. Light sensitivity is most commonly achieved by visual pigments formed from an opsin protein bound to a chromophore molecule. The eyes of the stomatopod crustacean, Neogonodactylus oerstedii, contain dozens of opsins which probably arose through gene duplication, but we previously reported that only four opsins are expressed in the cerebral ganglion, or brain, of N. oerstedii. We also reported that both sighted and blinded stomatopods respond to illumination by flipping, walking, and/or swimming and suggested that stomatopods probably have opsin-based extraocular photoreceptors. Light detection is an important sensory modality for stomatopods, so the presence, location, and physiology of extraocular light detectors in these arthropods may help us predict the function of these receptors. In other arthropods, the extraocular opsin location is related to its presumed non-visual function. In the red swamp crayfish, Procambarus clarkii, two opsins are expressed in nerve fibers extending from the brain to the site of well-characterized caudal photoreceptors that elicit leg movements. Here, we present our data localizing opsin expression within the brain of N. oerstedii by in situ hybridization, which informs future work exploring the possible electrophysiological photoresponses of these putative receptors.

53. Christopher Cooper

Chemistry

Temperature Dependence of Electron Transfer in Organic Charge Transfer Complexes

Electron transfer processes are fundamental to chemistry. Elucidation of electron transfer parameters of the Fermi Golden Rule model allows a greater understanding of the processes involved during electron transfer. Previous research described the electron transfer parameters of charge transfer complexes in solution which assumed a single normal mode was involved the electron transfer. The current study uses Fluorescence and excitation spectroscopy to analyze photo-induced electron transfer in solid state charge transfer complexes. Solid state charge transfer complexes will not have solvent changing reorganizational energies, Gibbs energies and electronic coupling. Parameters were determined for ambient temperature and 77.3 K by fitting emission and excitation spectra to the Golden Rule model while still assuming a single mode. The low temperature data should begin to exhibit the fine vibrational structure and describe possible dominant normal modes defining the spectra. Fitting emission and excitation spectra of the crystals demonstrated more exergonic Gibbs energies than solvent counterparts moving electron transfer deeper into the Marcus-Hush inverted region implying a decrease the rate of back electron transfer. A reduction in reorganizational energies is seen moving to colder temperatures and will be described. The normal modes of the charge transfer complexes will be defined using Raman spectroscopy. The resulting Stoke's shifts give exact vibrational information about the normal modes of the charge transfer complexes. Moving the Raman scatter into resonance demonstrates an increase in signal intensity that correlates the enhanced

normal mode(s) directly with absorption and emission. The absorption and emission spectra can be predicted with the enhanced normal mode(s). The enhanced bands also grant a view of which modes are play a key role during electron transfer. The low temperature data imply that multiple modes are involved in electron transfer where previous models assumed a single mode. The Raman spectra predicted absorption and emission spectra will corroborate the low temperature findings.

54. Marilyn Allen
Chemical, Biochemical, and Environmental Engineering

Lipid-tailed biomolecules like the natural Toll-like receptor (TLR) 2 agonists Pam2CSK4 and Pam3CSK4 rapidly insert into immune cell plasma membranes without genetic modification or a vector, termed lipo-depoting. Our lab and others have shown that lipo-depoted CD8+ T cells provide intercellular signaling that can activate bystander, non-depoted B cells in co-culture. This study explored the immune enhancing properties of lipo-depoted T cells co-cultured with CD11c+ bone marrow-derived dendritic cells (BMDCs). We hypothesized that Pam2CSK4 or Pam3CSK4 depoted T cells would activate a signaling cascade in co-cultured BMDCs to enhance the activation of T cells. Our data showed that co-cultured populations led to increased expression of activation markers CD25, CD69, CD86 and increased production of the cytokine granzyme B. These results suggest that lipo-depoting has potential as a novel strategy to enhance cell-based immunotherapy, increasing CD8+ T cell activation via intercellular signaling to BMDCs in immunosuppressive environments.

55. Zhen Qi
Electrical Engineering

Comb generation in microresonators is governed by the Lugiato-Lefever equation . It has recently been established that broadband combs can be obtained using solitons. Solitons are a special case of cnoidal waves, and other cnoidal waves that correspond to narrowband combs can have important applications by making it possible to tailor the combs to specific applications. In this presentation, we discuss the accessibility, stability, and methods for generating cnoidal wave solutions.

56. Brent McBride
Atmospheric Physics
Preparing to Launch UMBC's First Full-Feature Earth Sciences Satellite: The Hyper-Angular Rainbow Polarimeter (HARP)

Aerosol-cloud interaction is among the most important and still least understood contributor to climate change. Remote sensing instruments on satellite, aircraft, and ground stations fill the vital role in sampling aerosol-cloud scenes with global coverage; their retrievals improve climate models and narrow uncertainties in estimating climate forcing. Still, traditional radiometric studies of clouds and aerosols are biased: these instruments are not sensitive to non-spherical particles and have difficulty distinguishing two different scenes with the same statistical particle size. The Laboratory for Aerosols, Clouds, and Optics (LACO) at UMBC presents the Hyper-Angular Rainbow Polarimeter (HARP) CubeSat, a wide-FOV imaging polarimeter capable of performing highly accurate retrievals of cloud and aerosol microphysical properties from space. The hyper-angular capability provides the sampling of cloud parameters at higher angular and

spatial resolution than POLDER (CNES). This advanced microsatellite is positioned as a precursor to the multi-angle imaging polarimeter required for the upcoming NASA Aerosols, Clouds, and Ecosystems (ACE) mission. This presentation will discuss the polarimetric calibration and accuracy of the HARP instrument, preliminary cloudbow retrievals from the Passive Aerosol and Cloud Suite (PACS) instrument, the HARP proof-of-concept imaging polarimeter that took part in the NASA PODEX campaign in 2013, and applications of HARP/PACS science to climate research. The HARP CubeSat will launch in August 2017 for a mission lifetime of up to one year. The inclined orbit of HARP CubeSat will allow for co-incident measurements over AERONET ground stations and under NASA EOS satellites for both land and ocean targets.

57. Cassie Nelson

Biological Sciences

Functional Characterization of the GH3 Beta-glucosidases in the Saprophytic Bacterium Cellvibrio japonicus

Degradation of polysaccharides forms an essential arc in the carbon cycle, provides a percentage of our daily caloric intake, and is a major driver in the renewable chemical industry. Microorganisms proficient at degrading insoluble polysaccharides possess large numbers of carbohydrate active enzymes, many of which have been categorized as functionally redundant. Here we present data that suggests that carbohydrate active enzymes that have overlapping enzymatic activities can have unique, non-overlapping biological functions in the cell. Our comprehensive study to understand cellodextrin utilization in the soil saprophyte Cellvibrio japonicus found that only one of four predicted β-glucosidases is required in a physiological context. Gene deletion analysis indicated that only the cel3B gene product is essential for efficient cellodextrin utilization in C. japonicus and is constitutively expressed at high levels. Interestingly, expression of individual β-glucosidases in Escherichia coli K-12 enabled this non-cellulolytic bacterium to be fully capable of using cellobiose as a sole carbon source. Furthermore, enzyme kinetic studies indicated that the Cel3A enzyme is significantly more active than the Cel3B enzyme on the oligosaccharides but not disaccharides. Our approach for parsing related carbohydrate active enzymes to determine actual physiological roles in the cell can be applied to other polysaccharide-degradation systems.

58. Maithilee Joshi

Computer Sciences

Securing critical documents from any internal or external threats is a major issue faced by all organizations today. Controlling and limiting access to such documents requires a stable and robust access control mechanism. In this paper, we propose a semantically rich access control system that employs an access broker module to evaluate an access decision based on rules generated using an organization's confidentiality policies. The proposed system analyzes the multi-valued attributes of the user making the request and requested document that is stored on a cloud service platform, before making a decision. Furthermore, our system guarantees an end-to-end oblivious data transaction between the organization and the cloud service provider using oblivious storage techniques. Thus, an organization can use our system to secure their documents as well as obscure their access pattern details from an untrusted cloud service provider.

59. Stacey Sova

Chemistry

Photoaffinity Labeling and Photooxidative Crosslinking with Naphthalene Imide and Diimide Derivatives

Protein structure and protein complex structures are crucial to determining their biological function. Current NMR and x-ray crystallography techniques have limitations that can be overcome with the use of photoaffinity labeling and photooxidative crosslinking. . Upon irradiation, photooxidative crosslinking compounds produce a covalent bond between separate proteins without modifying the amino acids on the surface to determine enzymes present within a complex formation. Photoaffinity labeling covalently binds a protein to a chemical probe with irradiation to determine structure of a particular site on the protein. Our lab uses a family of naphthalene imide (NI) and diimide (NDI) compounds to do these photoactivatable techniques in order to improve structural-based drug design. NI-Alanine covalently crosslinked lysozyme structures together as shown by SDS-PAGE while NI-Tyrosine site specifically targeted the active site of mushroom tyrosinase monitored by fluorescence and colorimetric enzyme kinetics. These naphthalimide compounds can be used for photooxidative crosslinking to determine protein complex formations. NDI-Alanine non-specifically labeled bovine serum albumin and was verified by HPLC. We are currently determining the mechanism of action of these naphthaldiimide compounds in order to use them as photaffinity labels for active sites of mushroom tyrosinase and myokinase using fluorescence, mass spectrometry and NMR.

60. Scott Riley

Chemistry

DR-COD was found in 47 (29.7%) deceased participants, 13.7% (n=28) identified as cognitively impaired by both 3MS and chart; 13.7% (n=28) by 3MS alone, 12.8% (n=26) by chart alone; and 58.33% (n=119) were not cognitively impaired. Those with cognitive impairment by both 3MS and hospital chart had a 11.6 greater odds of DR-COD (p=<.0001, 95%CI: 4.52-29.71) than those identified by neither (ref=1). Odds of DR-COD among those identified by 3MS alone were 5.12 (95%CI: 2.54-10.30); 4.313 by hospital chart alone (95%CI: 2.15-8.66). 3MS detected impairment in 19.2% of patients who later died of DR-COD that were otherwise missed using only hospital charts.

61. Therese Ku*,*

Chemistry

Synthesis of Flexible, Purine Analogue Inhibitors of NCp7

Anti-HIV-1 drug design has been notably challenging due to the virus' ability to mutate and develop immunity against commercially available drugs. This project aims to discover a new series of nucleobase analogues that not only possess inherent flexibility that could withstand active site mutations, but also target a non-canonical, more conserved target, NCp7. Interestingly, these compounds are not predicted to work by zinc ejection, which would endow them with significant advantages over currently reported zinc-ejectors, which are toxic. We have synthesized several series of these fleximer base analogues using palladium-catalyzed coupling techniques and tested them against NCp7 specifically, and HIV-1 in general. One analogue has shown interesting activity, showing potential binding patterns with NC in a proton NMR experiment, and HIV-1 inhibition. The results are shown herein.

Presenter Index

John Winder	Microtalk Session I - 10:00 - 10:45am, UC 310
Jonathan Graf (#51)	Poster Session II - 1:45 - 2:30pm, UC 312
Jong S. Park (#33)	Poster Session I - 11:00 - 11:45am, UC 312
Josey Stevens (#31)	Poster Session I - 11:00 - 11:45am, UC 312
Josh Moskowitz (#44)	Microtalk Session I - 10:00 - 10:45am, UC 310 Poster Session II - 1:45 - 2:30pm, UC 312
Joshua D Brown	Microtalk Session II - 1:45 - 2:30pm, UC 310
Julie Nyman (#42)	Poster Session II - 1:45 - 2:30pm, UC 312
Justin Velez-Hagan	Microtalk Session I - 10:00 - 10:45am, UC 310
Kartikeya Joshi (#39)	Poster Session II - 1:45 - 2:30pm, UC 312
Katherine Ralston	Microtalk Session I - 10:00 - 10:45am, UC 310
Ke He	Microtalk Session II - 1:45 - 2:30pm, UC 310
Kiranmayi Prakash Mangalgiri (#19)	Poster Session I - 11:00 - 11:45am, UC 312
Laura King	Microtalk Session I - 10:00 - 10:45am, UC 310
Mahdad Talebpour (#43)	Microtalk Session 1I - 10:00 - 10:45am, UC 310 Poster Session II - 1:45 - 2:30pm, UC 312
Maithilee Joshi (#58)	Poster Session II - 1:45 - 2:30pm, UC 312
Mamatha Hopanna (#20)	Poster Session I - 11:00 - 11:45am, UC 312
Maraki Negesse (#29)	Poster Session I - 11:00 - 11:45am, UC 312
Marilyn Allen (#54)	Poster Session II - 1:45 - 2:30pm, UC 312
Marshall Washick (#6)	Panel Session II - 11:00 - 11:45am, Ballroom Lounge
Marwa El-Sayed (#8, #45)	Panel Session II - 11:00 - 11:45am, Ballroom Lounge Poster Session II - 1:45 - 2:30pm, UC 312
Mary Donohue (#52)	Poster Session II - 1:45 - 2:30pm, UC 312

Mary Keenan (#14)	Poster Session I - 11:00 - 11:45am, UC 312
Mary Yates (#34)	Poster Session I - 11:00 - 11:45am, UC 312
Michael A. Battaglia Jr. (#7)	Panel Session II - 11:00 - 11:45am, Ballroom Lounge
Michael Zhang (#17)	Microtalk Session II - 1:45 - 2:30pm, UC 310 Poster Session I - 11:00 - 11:45am, UC312
Miji Jeon (#48)	Poster Session II - 1:45 - 2:30pm, UC 312
Mirelis Santos Cancel (#15)	Poster Session I - 11:00 - 11:45am, UC 312
Muhammad Mahbubur Rahman (#18)	Poster Session I - 11:00 - 11:45am, UC 312
Natalie Roberts (#38)	Poster Session II - 1:45 - 2:30pm, UC 312
Nopondo N. Esemoto (#21)	Microtalk Session II - 1:45 - 2:30pm, UC 310 Poster Session I - 11:00 - 11:45am, UC 312
Preethi Somasundaram	Microtalk Session I - 10:00 - 10:45am, UC 310
Rachael Knoblauch (#47)	Microtalk Session I - 10:00 - 10:45am, UC 310 Poster Session II - 1:45 - 2:30pm, UC 312
Richard Brewster (#40)	Poster Session II - 1:45 - 2:30pm, UC 312
Rickesh Patel (#33)	Poster Session I - 11:00 - 11:45am, UC 312
Robert Kentucky Burton (#12)	Panel Session III - 1:45 - 2:30pm, Ballroom Lounge
Ruken Isik (#5)	Panel Session I - 10:00 - 10:45am, Ballroom Lounge
Sai Kumar Popuri	Microtalk Session II - 1:45 - 2:30pm, UC 310
Saman Nezami (#30)	Poster Session I - 11:00 - 11:45am, UC 312
Scott Riley 2nd (#60)	Poster Session II - 1:45 - 2:30pm, UC 312
Seyedahmad Mousavi	Microtalk Session II - 1:45 - 2:30pm, UC 310
Shaokang Wang (#1)	Panel Session I - 10:00 - 10:45am, Ballroom Lounge
Shawntay Stocks (#4)	Panel Session I - 10:00 - 10:45am, Ballroom Lounge

Stacey Sova (#59)	Poster Session II - 1:45 - 2:30pm, UC 312
Stephanie Smith (#13)	Panel Session III - 1:45 - 2:30pm, Ballroom Lounge
Sushant Athley	Microtalk Session I - 10:00 - 10:45am, UC 310
Therese Ku (#61)	Poster Session II - 1:45 - 2:30pm, UC 312
Tonya Santaus (#46)	Poster Session II - 1:45 - 2:30pm, UC 312
Trevor Needham	Microtalk Session I - 10:00 - 10:45am, UC 310
Tyrone E. McKoy, Jr.	Microtalk Session II - 1:45 - 2:30pm, UC 310
Utsav Shashvatt (#22)	Poster Session I - 11:00 - 11:45am, UC 312
Yangling Zhou (#25)	Poster Session I - 11:00 - 11:45am, UC 312
Zhen Qi (#55)	Poster Session II - 1:45 - 2:30pm, UC 312
Zheng Zheng (#49)	Poster Session II - 1:45 - 2:30pm, UC 312