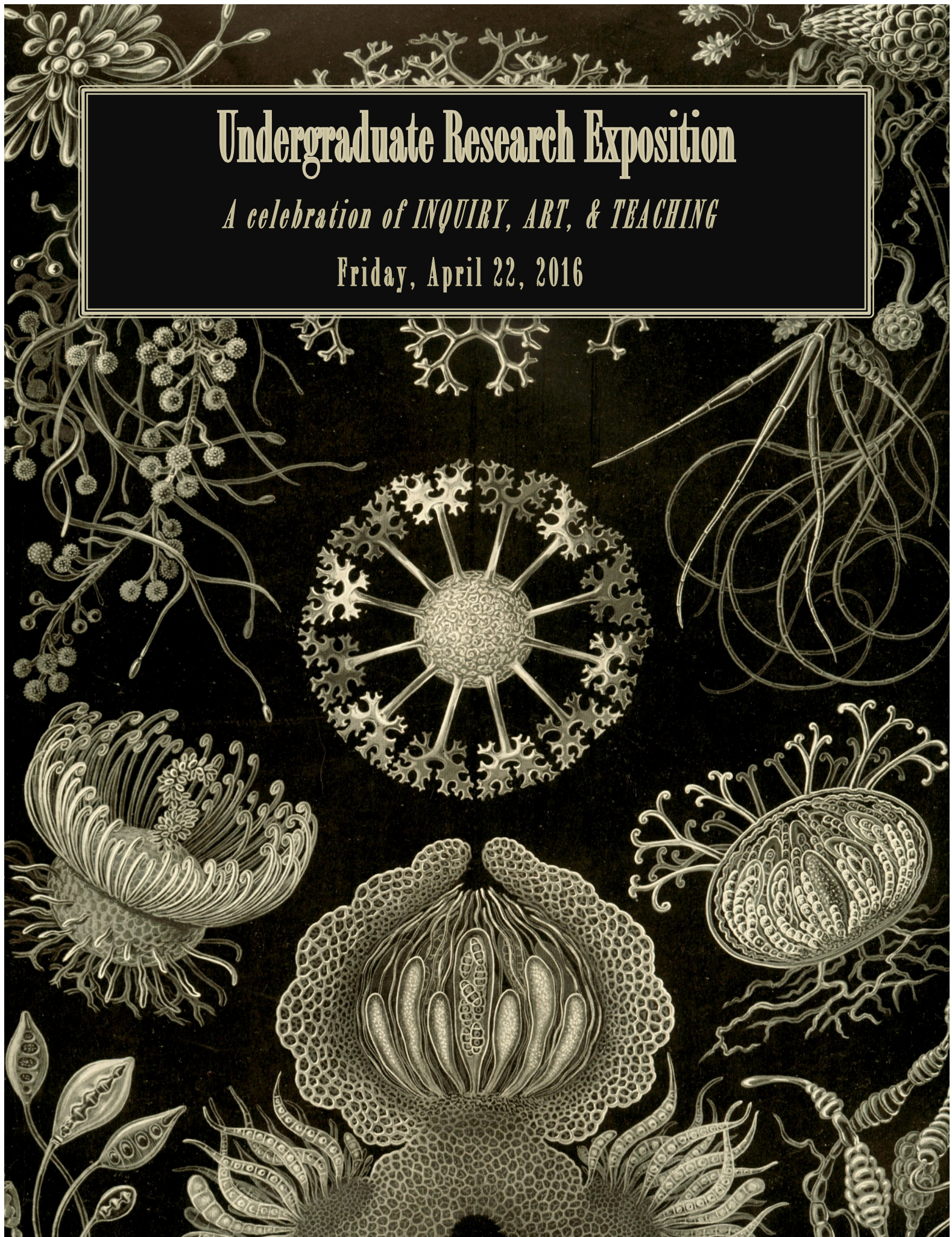


Undergraduate Research Exposition

A celebration of INQUIRY, ART, & TEACHING

Friday, April 22, 2016



Order of Events

12:30 p.m.

SYMPOSIUM TALKS

Engineering & Applied Sciences

Meliora 221

Humanities

Dewey 2-110D

Natural Sciences & Mathematics

Bausch & Lomb 106

Social Sciences

Welles-Brown Room, Rush Rhees Library

2:00 p.m.

POSTER SESSION

Hawkins-Carlson Room

Rush Rhees Library

3:10 p.m.

UNDERGRADUATE RESEARCH AWARDS

VISUAL ART IN UNDERGRADUATE RESEARCH AWARDS

SA PROFESSOR OF THE YEAR AWARDS

Hawkins-Carlson Room

Rush Rhees Library

3:55 p.m.

CLOSING REMARKS

Hawkins-Carlson Room

Rush Rhees Library

***Engineering & Applied Sciences
Meliora 221***

12:30 p.m.

***Sarah Bjornland '17
Optical Engineering
Mentor: Professor Jennifer Hunter***

***"Ex vivo Two-Photon Autofluorescence and Confocal
Reflectance Microscopy"***

12:50 p.m.

***Madeleine Laitz '16
Chemical Engineering
Mentor: Professor David Wu***

"Toxicology and Environmental Prevalence of Rare Earth Elements"

1:10 p.m.

***Andrew Stern '16
Electrical & Computer Engineering
Mentor: Professor Roman Sobolewski***

***"Ultra-High Responsivity of Optically-Active Semiconducting
Asymmetric Nano-Channel Diodes"***

*Abstracts available in final pages

*Humanities
Dewey 2-110D*

12:30 p.m.

*Jennifer Dombroski '16
Linguistics
Mentors: Mr. Jim Kuhn & Dr. Marie Turner*

*“Manuscript Mysteries & Medieval Monasteries: An Inventory of the
St. Victor of Marseille Library”*

12:50 p.m.

*Angela Remus '16
International Relations / Spanish
Mentor: Professor Beth Jorgensen*

*“Legal Testimony, Literary Testimony, and the Production of
Truth in Guatemala”*

1:10 p.m.

*Nicola Francesco Tavella '17
Women's Studies / Health, Behavior & Society
Mentor: Professor Julianne Heck*

*“Analyzing the GBF's Role in Accessorizing Gay Men and
Reinforcing the Peter Pan Syndrome”*

*Abstracts available in final pages

*Natural Sciences & Mathematics
Bausch & Lomb 106*

12:30 p.m.

*Kelsey Csumitta '17
Brain & Cognitive Sciences / Psychology
Mentor: Professor Jessica Cantlon*

“Origins of Gender Differences in Mathematics”

12:50 p.m.

*Md. Tanveer Karim '16
Physics & Astronomy
Mentor: Dr. Cesar Briceno*

*“The Rotation Period Distribution of 4-10 Myr T Tauri Stars in the
Orion OB1 Association”*

1:10 p.m.

*Alicia Wei '18
Neuroscience / Mathematics
Mentor: Professor Andrew Wojtovich*

*“Optogenetic Control of ROS Production in C. elegans using
CRISPR/Cas9 Fusion Proteins”*

*Abstracts available in final pages

Social Sciences
Welles-Brown Room, Rush Rhees Library

12:30 p.m.

Katherine Brown '17 & Myranda Steingraeber '17
American Sign Language / Psychology (Brown)
Neuroscience (Steingraeber)
Mentor: Professor Laura Silverman

“Transition to Medication Self-Management for Youth with ASD”

12:50 p.m.

Kate Cowie-Haskell '16
Anthropology
Mentor: Professor Kristin Doughty

*“Organic Farming as Protest: Fighting Globalization with
Localization in Rural Thailand”*

1:10 p.m.

Chiziterem Onyekwere '17
Health, Behavior & Society
Mentor: Corey Nichols-Hadeed, J.D.

*" A Brief Exploration into the Needs of Human Trafficking Survivors
within Monroe County Pre-Trial Services"*

*Abstracts available in final pages

Poster Exhibition Participants

ENGINEERING & APPLIED SCIENCES

Ibrahim Akbar '17
Electrical & Computer Engineering
“Brain Computer Interface Using the Emotiv EPOC+ for Radio Tuning
and Volume Control”

Jonathan Boualavong '16 (Take 5 '17)
Biomedical Engineering
“Electrochemical Harvesting of Photosynthetic Biocurrent from
Chlamydomonas reinhardtii”

Justin Fraumeni '17
Electrical and Computer Engineering
“MOTIVE: MANET Optimization Through Interaction,
Visualization, and Evaluation”

Rabi Shrestha '16
Electrical and Computer Engineering
“Terahertz Spectroscopy of Graphene-Polymer Nanocomposites”

NATURAL SCIENCES & MATHEMATICS

Larisa Bainton '16 & Emily Rowe '16
Vocal Performance (Bainton)
Brain & Cognitive Sciences / Psychology (Rowe)
“Rapid Adaptation and Generalization in Foreign-Accented Speech
Perception”

Gabrielle Bueno '17
Brain & Cognitive Sciences / Psychology
“Metacognitive Illusions in Monkeys”

Ashley Bui '17
Brain & Cognitive Sciences / Psychology

“Cognitive-Behavioral Therapy for Insomnia Effects on Objective Sleep and Subjective Insomnia Severity Among Survivors of Interpersonal Violence (IPV) with Posttraumatic Stress Disorder”

Korin Carpenter '16
Applied Mathematics

“Identifying Active Faults in Northeast North America”

Connor Drooff '16
Geological Sciences

"Characterization of Lower Crustal Earthquakes in Southern Lake Tanganyika, Tanzania"

Tessa Eagle '16
Brain and Cognitive Sciences

“Language and Motor Development in Infants based on Observation and Parental Report”

Amy Eisenstadt '16
Geobiology

“Quantifying and Mapping Chloride Ion Runoff into the Genesee River from Winter Salting on the University of Rochester Campus”

Amy Elias '16
Molecular Genetics

“Redox Stress Mediates PSGL-1 Induction During Latent HIV-1 Infection”

Natalia Galant '16 & Danika Teverovsky '16
Neuroscience (Galant)

Brain & Cognitive Sciences (Teverovsky)

“Visualizing Population Model Responses of Peripheral, Brainstem and Midbrain Neurons to Complex Sounds”

Bethany Gardner '18, Anaclare Sullivan '18 & Tyler Trine '16

Brain & Cognitive Sciences (Gardner)

Epidemiology / Brain & Cognitive Sciences (Sullivan)

Data Science (Trine)

“Speaker-Specific Modulations of Real-Time Visual Search Behaviors to Pragmatic Unreliability”

Jenna Glatzer '17

Neuroscience

“SOX2 and Progenitor Proliferation in the Mammalian Inner Ear”

Abby Haslinger '17

Brain and Cognitive Science

“Is Center-Embedded Sequencing the Limiting Factor of Language?”

Julia Iourinets '16

Neuroscience

“The Hippocampus Projects to Bed Nucleus of the Stria Terminalis but not the Central Amygdala Nucleus in Primate”

Rebecca Joseph '17

Molecular Genetics

“Assessing Nucleic Acid Binding Capabilities of HIV Host Defense Factor APOBEC3G Mutants”

Lauren Kemperman '17

Data Science

“Web Application to Assess and Compare Competing microRNA Quantification Algorithms”

Richard Ladley '16

Chemistry

“Studies toward the total synthesis of the immunosuppressant FK-506”

Valerie Langlois '16

Brain & Cognitive Sciences / Linguistics

“Feature Saliency and Availability of Alternatives in Rational Language Comprehension”

Rosa Park '17

Biochemistry

“Using Tandem Mass Spectrometry to Identify the Oxidative Stress-Induced Phosphoproteome and Ribosylome of Human Foreskin Fibroblasts”

Katherine Peterson '16
Geological Sciences

“Geometry and Kinematics of the Northern Malawi Rift System”

Emily Prentiss '16
Brain & Cognitive Sciences

“The Role of the Parvocellular Pathway in Fast Visuomotor Updating”

Gabryella Pulsinelli '16
Environmental Studies / Studio Art

“Media and the Environment: How Can Visual Representation Teach us about Climate Change”

Tarin Rickett '18
Brain & Cognitive Sciences / Computer Science

“Navigating Uncertainty and Confidence: An Investigation into our Perceptual Decision-Making”

Jing Wang '16 (Take 5 '17)
Neuroscience

“Intravital *Xenopus* Tadpole Model for Investigating the Blood Brain Barrier (BBB) Function During Inflammation and Viral Infection”

Alexander Weinstein '16
Environmental Sciences
“Seismicity Patterns around Oldoinyo Lengai and Gelai Volcanoes, Africa”

Eugenia Zeng '17
Cell & Developmental Biology
“A Novel Mechanism Linking Sympathetic Nervous System Activation and Cancer Progression; Beta-adrenergic Receptor Regulation of Cancer-Derived Exosomes”

SOCIAL SCIENCES

Sanuja Bose '16 & Michael Healey '16

Health, Behavior & Society / Neuroscience (Bose)

Health, Behavior & Society / Biology (Healey)

“Health in the Himalayas: An Assessment of Health Needs in Matho,
India”

Nicole Kase '18 & Erin Muir '18

Health, Behavior & Society (Kase)

Environmental Health (Muir)

“‘We are less and less’: The Diminishing Self-efficacy of Youth in an
Alpine Community”

HUMANITIES

Pedro Piñera '16

Studio Art / Art & Art History

“Perceptions about the Built Environment”

Student Association Professors Of The Year

Humanities:

Professor Kirt Komocki

Department of Modern Languages & Cultures (Spanish)

Engineering:

Professor Laurel Carney

Department of Biomedical Engineering

Natural Sciences:

Professor David Goldfarb

Department of Biology

Social Sciences:

Professor Stuart Jordan

Department of Political Science

Undergraduate Research Awards

3:15 p.m.

PROFESSOR STEVEN MANLY

Introductory Remarks

3:18 p.m.

PRESIDENT JOEL SELIGMAN

Presentation of the President's Awards for Undergraduate Research

3:28 p.m.

PROFESSOR STEVEN MANLY

***Presentation of the Deans' Awards for Undergraduate Research in
Engineering & Applied Sciences, Humanities, Social Sciences,
Natural Sciences & Mathematics***

***Presentation of the Professors' Choice Awards for
Undergraduate Research***

3:40 p.m.

Students' Association Professor of the Year Awards

3:55 p.m.

PROFESSOR STEVEN MANLY

Closing Remarks

ABSTRACTS

Ibrahim Akbar '17

“Brain Computer Interface Using the Emotiv EPOC+ for Radio Tuning and Volume Control”

Brain-Computer Interface (BCI) technology is the direct transmission of information between the brain and an external device. This form of communication is dependent on the users to produce discernable changes in their electroencephalographic (EEG) activity and for proper technology to record and analyze EEG activity efficiently and accurately. This provides for a non-muscular channel of communication that allows people with physical disabilities to interact with their environments. It also provides means for high-speed applications such as note taking, data processing, and bionic enhancements for prosthetics. The problem in this field is that EEG activity is susceptible to noise making the analysis difficult. This problem prompted Professor Dean to determine the feasibility of commercial EEG Headsets and further the technology to produce a more accurate and efficient software package. This process led to analyzing a product, the Emotiv EPOC+, to determine areas that require improvement and verifying the capabilities of BCIs with an external device (i.e. Radio System). Once the product was analyzed and tested with an external device, a software package for characterizing EEG activity was coded through MATLAB, which required various forms of feature extraction. These feature extractions included: Power Method, Continuous Wavelet Transform, and localization and tracking of oscillatory EEG data. This package is being produced and tested with EEG datasets. It was determined through the construction of the BCI that current BCIs are incapable of properly assessing a subject's intentions or analyzing them consistently. This is due to the signal – noise ratio and the variation in EEG activity per person. Thus BCIs require more research into robust applications for EEG analysis. The adjustment of thresholds, implementation of additional features, and BCI construction will be discussed.

Larisa Bainton '16 & Emily Rowe '16

“Rapid Adaptation and Generalization in Foreign-Accented Speech Perception”

Understanding speech can be difficult, especially when listening to someone with an accent. One important study (Clarke and Garrett 2004) reported that one minute of exposure significantly reduced accent-related difficulty. We successfully replicated two conditions of this study, and two additional conditions (one replication, one novel) are underway. To examine the effect of exposure to Mandarin-accented speech, we implemented a novel web-based paradigm. Subjects were exposed to the task in either a test (accented speaker) or control (unaccented speaker) condition. We measured participants' reaction times in a sentence-listening task. A linear mixed effect model was used to analyze reaction times. Subjects who were exposed to an accented speaker initially were slower, but this disadvantage quickly decreased and they improved significantly compared to subjects exposed to a native speaker. After exposure, both groups were tested on accented speech, and those who had not yet heard the Mandarin accent fared much worse (192 ms slower). These results showed that subjects were able to adapt to an accented speaker. Our error rates, however, were consistently higher for the group listening to accented speech, indicating that not all of the difficulty introduced with an accented speaker went away. This semester we are running two additional conditions to further demonstrate the rapid flexibility of human language processing. We hope to find that accent adaptation generalizes with short exposure beyond a single talker.

Sarah Bjornland '17

“Ex vivo Two-Photon Autofluorescence and Confocal Reflectance Microscopy”

Ex vivo microscopy of non-human primate retinal tissue is being performed to serve two purposes. The first is to histologically confirm findings discovered during *in vivo* microscopy of the retinal tissue. A virus was administered to the retina that targeted and damaged photoreceptors for the purpose of creating a model of retinal damage and the resulting vision loss. Such models can be used when investigating

methods of restoring impaired vision. The second purpose is to obtain more information about the fluorophores in each layer of the retina. The fluorophores provide insight about the biochemistry of the eye can be useful for monitoring both healthy and damaged eyes. Two modalities, two-photon autofluorescence and confocal reflectance were used to image the tissue sample. An adaptive optics scanning light ophthalmoscope with an additional arm for ex vivo microscopy was utilized. The system has been optimized for dispersion and additional steps have been taken to increase the control in the position of the retina while imaging, including integrating a motorized translation stage into the system. The resolution of the system was determined using a 1951 USAF resolution target and was found to be approximately $2\mu\text{m}$, allowing individual cells of the retina, such as photoreceptors, to be resolved. Thus far, photoreceptors have been identified in the two-photon autofluorescence and confocal reflectance images. With further optimization of the system and sample imaging, identification of other retinal cell layers is expected.

Sanuja Bose'16 & Michael Healey'16

“Health in the Himalayas: An Assessment of Health Needs in Matho, India”

As globalization alters the social and cultural characteristics of communities around the world, gradual changes in health behaviors, exposures, and public health infrastructure have contributed to both positive and negative health outcomes. For instance, dietary changes and increased tobacco use have contributed to increased rates of chronic conditions like obesity and cancer, while improved access to medical services has prevented the spread of many acute, infectious diseases. In this study, we used an adapted version of India's National Family Health Survey to collect data from people living in Matho, India, and investigate whether or not health outcomes in this rural, Himalayan village could be linked to broader socioeconomic trends. To conduct this survey, we collaborated with Buddhist nuns at the Ladakh Nuns Association, who provided us with important information about Ladakhi society, culture, religious practices, and gender dynamics. After we taught the nuns about basic public health concepts and practices, they traveled with our team to Matho and helped us administer our survey to 76 randomly selected households and collect health statistics,

ethnographic data, and demographic information about 399 individual persons. Overall, our survey results suggested that the people of Matho were relatively healthy, although we did discover some negative health outcomes and possible health disparities within this rural, Himalayan village. Based on the results of this survey, we recommend that local government agencies and private organizations implement programs that encourage and support pre-existing positive health behaviors and expand access to medical services. Moreover, we recommend that similar surveys be conducted in other rural villages within the Indian district of Ladakh, and that these surveys be designed and implemented in cooperation with stakeholders from local communities.

Jonathan Boualavong '16 (Take 5 '17)

“Electrochemical Harvesting of Photosynthetic Biocurrent from *Chlamydomonas reinhardtii*”

With rapidly increasing energy demands and the known environmental impacts of fossil fuel combustion, research into alternative sources of energy is of great necessity. One of the most promising alternative sources is bioenergy due to its carbonneutral life cycle. Utilization of biomass as fuel, however, is a low efficiency process due to the energy losses in converting light to usable energy through photosynthesis. This project utilizes electrochemical methods to bypass those low efficiency processes and directly extract electrons from microalgal (*Chlamydomonas reinhardtii*) photosynthesis. Cells are deposited onto the surface of a gold electrode at the base of a microwell. P-benzoquinone (BQ), a cellpermeable molecule, is used to shuttle electrons from the photosynthetic electron transport chain to the gold working electrode. By applying a voltage between the working electrode and the platinum counter electrode, lightdependent biocurrent can be harvested. This novel method uses whole cells, making it fast, simple to perform, and capable of harvesting electrons from multiple cells simultaneously. The setup shows performance consistent with the hypothesis that the electrons are the result of natural photosynthesis, with the magnitude of biocurrent detected decreasing by >90% in the presence of DCMU, a photosystem II inhibitor; conversely, the magnitude generally increases with increasing light intensity. The influence of voltage bias was determined and was used to determine the optimal voltage for future experiments. Surprisingly, the biocurrent

collected does not show an increase when total electrode surface roughness increases, but this can be attributed to the high surface structure density making mass transport similar between the two systems studied. Surfaces with different morphologies to that will alter the mass transport model are being studied. Additionally, other electron shuttling molecules (FAD, riboflavin, 1,4-naphthoquinone, and methyl, 4-naphthoquinone) are being tested for their efficacy in transporting electrons from the intracellular space to the electrode.

Katherine Brown '17 & Myranda Steingraeber '17
“Transition to Medication Self-Management for Youth with ASD”

An estimated 30 to 60 percent of individuals with autism spectrum disorder (ASD) take at least one psychotropic medication. Despite widespread use, little is known about child and caregiver knowledge of medication regimens, attitudes towards taking medications, and perceived readiness for medication self-management. Addressing these questions has significant implications for adherence and treatment outcomes. To quantify medication knowledge, attitudes, and perceived readiness for transition to healthcare self-management in adolescents with ASD and their parents. Participants were 22 high-functioning adolescents with ASD between 14 and 17, and 22 of their parents. Both groups completed an hour-long interview and electronic survey addressing these topics. Medication knowledge was quantified via survey questions asking a list of current medications, and reasons for each medication. Medication attitudes were measured using a modified version of the South Hampton ADHD Medication Behaviour and Attitudes Scale (SAMBA; Harpur et al., 2008). Participants indicated the extent to which they agreed with statements about medication use, via a 32-item, 5-point Likert scale (1=strongly disagree, 5=strongly agree). Mean subscale scores were calculated, quantifying perceived costs and benefits of medication, patient stigma, and resistance to treatment. Readiness for healthcare self-management was measured via the Transition Readiness Assessment Questionnaire (TRAQ; Sawicki et al., 2011). Participants indicated their skill level related to healthcare self-management, via a 20-item, 5-point Likert scale (1=No-I don't know how, 5=Yes-I always do this when I need to). Mean subscale scores were calculated, quantifying ability to manage medications, keep appointments, track health issues, and talk with providers. The mean

number of medications taken by adolescents was 2.68 ((1.94); per parent report) and 1.33 ((1.20) per child report). A reason for taking every medication was provided by 100% of parents, and only 65% of adolescents. Mean SAMBA scores in both groups indicated a perceived low to moderate cost of medication use (child: 1.94 (.69); parent: 1.40 (.50)), resistance to the medication regimen (child: 1.82 (.63); parent: 1.73 (.54)), and stigmatization (child: 1.89 (.83); parent: 1.51 (.66)), while the benefits of medication were rated as moderate to high (child: 3.79 (.71); parent: 3.93 (.82)). Mean TRAQ subscale scores indicated very limited readiness for healthcare self-management: medication self-management (child: 1.49 (.84); parent: 1.05 (.83)), appointment keeping (child: 0.69 (.80); parent: 0.18 (.29)), healthcare tracking (child: 1.01 (1.06); parent: 0.45 (.66)), and talking to providers (child: 2.25 (1.13); parent: 1.89 (.65)). Intraclass correlations demonstrated a significant positive relationship between child and parent scores on the SAMBA's medication benefits subscale ($r = .56, p = .04$) and the TRAQ's medication management subscale ($r = .72, p = .004$); all other correlations between child and parent scores were non-significant. These findings suggest that individuals with ASD and their parents regard medication as beneficial, but parents and adolescents agree that adolescents have limited knowledge about their medications and feel unprepared to manage their own healthcare. These findings emphasize the need for enhanced education around healthcare self-management in transition planning for adolescents with ASD.

Gabrielle Bueno '17

“Metacognitive Illusions in Monkeys”

Metacognition is the ability to monitor your own awareness states, and it's important because it lets us make judgments like whether or not we need to keep studying for an exam. We're interested in seeing where metacognitive ability originated on the evolutionary scale, and whether monkeys are able to make metacognitive judgments similarly to humans. Studies have shown that humans will sometimes use cues in their environment, like perceptual fluency, to judge how certain they are about a decision, as opposed to using direct access to their own knowledge. To test if monkeys make metacognitive judgments in a similar way, we gave them a task that looked at whether perceptual fluency influenced their confidence judgments. We found that perceptual

fluency did influence their performance: easier to perceive stimuli were given a higher confidence rating than harder to see stimuli. This suggests that monkeys do make metacognitive judgments similarly to humans, and that this is an ability we share with other animals near us on the evolutionary chain.

Ashley Bui '17

“Cognitive-Behavioral Therapy for Insomnia Effects on Objective Sleep and Subjective Insomnia Severity Among Survivors of Interpersonal Violence (IPV) with Posttraumatic Stress Disorder”

Individuals who experience interpersonal violence (IPV) and have posttraumatic stress disorder (PTSD) often suffer from insomnia. We sought to compare the effects of cognitive-behavioral therapy for insomnia (CBTi) to a contact control condition on the objective and subjective sleep of participants with IPV and PTSD using polysomnography (PSG) and a validated insomnia scale respectively. We hypothesized CBTi would be associated with greater pre-post improvements in sleep than the control condition. Data were collected from a sample of IPV survivors who met DSM-IV-TR diagnostic criteria for PTSD. Following baseline measures and an in-lab, overnight PSG, participants were randomized to either the CBTi (n = 26) or control (n = 37) condition. At post-CBTi assessment, procedures were the same as baseline assessment with the exception that the PSG had a reduced montage. A total of 47 participants completed a follow-up PSG. General linear model, repeated measures analyses revealed a significant interaction between group and time, such that subjective insomnia (Insomnia Severity Index) scores decreased at a greater rate for the CBTi group ($F(1) = 35.392, p = 0.000$). This effect remained significant when controlling for age, ethnicity, and depression severity at baseline. Interestingly, this relationship did not extend to objective sleep variables, as significant changes were not observed when the same analyses were run for PSG-based total sleep time, sleep latency, sleep efficiency, or percentage of time in REM. The results suggest that CBTi is an effective treatment for insomnia that co-occurs with PTSD among IPV survivors, but that objective measures of sleep do not change significantly. This non-convergence of subjective and objective sleep data is not unprecedented in the larger CBTi literature, though we did expect improvements in REM sleep variables in the CBTi condition.

Further inquiry into the divergence of subjective and objective sleep reports in PTSD populations is warranted.

Kate Cowie-Haskell '16

“Organic Farming as Protest: Fighting Globalization with Localization in Rural Thailand”

This project uses three weeks of ethnographic field research in rural Thailand to examine the rise of agrarian peasant movements and explore how they allow the rural poor to assert control over the future in the face of daunting threats from globalization, industrialization, and the corporatization of agriculture. The research examines the ways these agrarian movements serve communities that have been negatively impacted by industrial development projects (dams, power plants, etc.). I focus specifically on the intersection of agrarian movements with organic farming in these communities and ask why organic farming has overwhelmingly been chosen as the central strategy of their movement. I argue that organic agriculture is uniquely suited to helping these communities achieve their shared goal of self-sufficiency and sustainability because of three factors inherent to organic agriculture: 1) a high investment of labor and relatively low investment of capital, 2) the necessity of government involvement in the production and marketing of organic products, and 3) its current market popularity among the urban elite in Thailand.

Korin Carpenter '16

“Identifying Active Faults in Northeast North America”

Multiscale edge Poisson wavelet analyses of potential field data ("worms") have a physical interpretation as the locations of lateral boundaries in a source distribution that exactly generates the observed field. The worm technique is therefore well suited to analyses of crustal-scale structures that could be reactivated by tectonic stress or by fluid injection processes, providing new tools to analyze existing continental-scale data sets. For the purpose of extending basement structure beneath the Appalachian basin and establishing a consistent regional basis for comparison, we use worms to identify steeply dipping structures in compiled gravity and magnetic anomaly data sets. We compare results to intraplate earthquake locations to assess seismic hazards. Clearly, not all

locations of lateral boundaries are faults, and we do not expect all faults to have shown activity in the ~50 years of seismic records available. However, proximity statistics between hypocenters and worms are of interest since they assist in the identification and location of a subset of potentially active faults. We compare structures of lateral mass density or magnetization contrast with locations of earthquake hypocenters cataloged from the ANF using the EarthScope Transportable Array. We then develop a GIS based method for calculating hypocenter/worm proximity, and we show statistics and maps from this method for the region at the meeting.

Kelsey Csumitta '17

“Origins of Gender Differences in Mathematics”

Despite advances in gender equality within our society, men continue to be overrepresented in math-related careers. If there are “innate” differences in math ability between young boys and girls, these differences may impact later academic and career choices. Although a large body of research has examined early gender differences in visuospatial abilities, none have looked closely at early math ability without confounding number and space. Additionally, early math ability has been measured with school grades, which is not a true measure of achievement. Our study investigates early gender differences in math achievement and the foundations of formal mathematical skills independent of visuospatial ability in a large sample of 2- to 7-year-old children. Boys within our sample performed better on a rote memorization counting task, and on formal math questions (those taught explicitly in school). However, there was no difference between boys and girls on other measures of math achievement or numerical acuity. This suggests that cultural influence may account for the gender discrepancy seen in math-related careers, such that boys may be more extrinsically or intrinsically encouraged to rehearse numerical information at an early age.

Jennifer Dombroski '16

“Manuscript Mysteries & Medieval Monasteries: An Inventory of the St. Victor of Marseille Library”

Sometime between 1850 and the 1920s, the Rare Books and Special Collections at the University of Rochester acquired by unknown means an approximately 500-year-old catalogue of a monastic medieval library. These four pieces of vellum are a treasure, not simply for the answers they provide, but more for the questions they pose. In its own right, this medieval document records the important spiritual and legal volumes of the monks at the monastery of St. Victor in Marseille, France in 1374. By nature of its links to the history of this specific monastery, medieval libraries in general, and the history of manuscript dispersal, this document encourages discovery in a much larger body of knowledge. The nature of this research has been to synthesize individual resources about the St. Victor catalogue and monastery to provide future researchers with a central source of information. Specifically, this has involved compiling an annotated bibliography of sources, constructing a virtual timeline of the monastery's history, and setting up a searchable Excel database of the works listed in the 1374 catalogue, as well as in the four other catalogues created for the monastery at various dates before and after the 1374 manuscript. Overall, the 1374 St. Victor catalogue is an important holding of the Rare Books and Special Collections library that can be better appreciated through this research.

Connor Drooff '16

“Characterization of Lower Crustal Earthquakes in Southern Lake Tanganyika, Tanzania”

The Southern Tanganyika and the N. Tanzania Divergence (NTD) zones are the most seismically active areas (energetically) in the East African rift zone, and they both developed in thick, cold Archaean-Proterozoic lithosphere. They also host lower crustal earthquakes. Are lower crustal earthquakes evidence for normal faults that penetrate mafic, cold lower crust, or are they zones of active magma intrusion and high stressing rates/overpressure? Whereas the NTD has a 6 My history of magmatism, the S Tanganyika rift zone is apparently amagmatic, We use new data from CRAFTI and TANGA14 experiments to compare and contrast

seismicity patterns in these 2 sectors, and compare with new and existing results.

Tessa Eagle '16

“Language and Motor Development in Infants based on Observation and Parental Report”

Infants begin walking and talking around 12 months of age. Recent research has suggested a possible link between the development of language and walking, namely that early walkers have larger receptive and productive vocabularies (Walle & Campos 2014, He et al. 2015). Here, we examine longitudinal data for 6-18 month olds (n = 44) to determine if walkers are more linguistically advanced than same-age crawling counterparts. By replicating previous studies with the added component of longitudinal observational data, which better allows for more accurate observation of motor and linguistic abilities, the validity of parental report is assessed. Current analysis shows similar word averages in productive and receptive vocabulary to that of the previous research, though crawlers and walkers in this sample are not showing significant difference in vocabulary, contrary to the prior research finding that walkers had higher vocabularies (He et al. 2015). Age of pointing onset will be used as a nonverbal measure to examine early non-linguistic cognitive abilities. This research will contribute to current knowledge on the link between vocabulary and motor development, adding novel evidence of how well parental report aligns with observed walking and talking in infants.

Amy Eisenstadt '16

“Quantifying and Mapping Chloride Ion Runoff into the Genesee River from Winter Salting on the University of Rochester Campus”

The average conductivity of Irondequoit Bay in Rochester, NY during the winter months has rested at approximately 300 mS/cm.¹ After February 2015, however, the coldest February in Rochester on record, that conductivity doubled. Analysts from Monroe County’s Department of Environmental Services attribute this change entirely to road salt

¹ Sansone, Andy. Personal interview. Sept. 2015.

application, and subsequent runoff into the bay.² We expect that a similar phenomenon can be observed in the Genesee River lining the University of Rochester Campus. The campus' storm sewer system feeds directly into the river at 8 outfalls, illustrating the potential for a significant portion of road salt applied on the campus to meet its fate in the river. From October 2015 to April 2016, we sampled the storm sewer pipes consistently. Baseline samples were obtained both prior to winter temperatures and snowfall, and then throughout the winter at the time of large-scale melting events. The main target of analysis is chloride ions, which can be harmful to both flora and fauna comprising the river's ecosystem. A conductivity probe was used to achieve conductivity measurements of all samples, and graphical data then constructed to represent chloride ion runoff in response to salting and melting. Average USGS conductivity measurements of the Genesee³ show that even the minimum conductivity in winter exceeds acceptable values for aquatic organisms.^{4,5,6} This assumes that conductivity signals are derived entirely from chloride ions, and as such, we will look into the possible presence of other ions contributing to conductivity. Long-term impacts of this research involve encouraging our campus to become an active supporter of the Genesee's health, in addition to creating and distributing editable GIS (Geographic Information Systems) maps of the sewage system and campus hydrology to allow for coordination between Facilities, Utilities, and Horticulture and Grounds. This work suggests the need to coordinate efforts to reduce total runoff into surrounding ecosystems, highlights the necessity of bioretention systems, and allows us to use GIS mapping to plan more effective placement of these systems.

² Ibid.

³ USGS. New York Water Data Support Team. *USGS Surface-Water Daily Statistics for the Nation*. N.p.: n.p., n.d. *Surface Water data for USA: USGS Surface-Water Daily Statistics*. Web. 1 Mar. 2016.

<<http://nwis.waterdata.usgs.gov/nwis/dvstat?>>.

⁴ "Concentration - Solution Conversion Table." *UnitConversion.org*. Accelware, n.d. Web. 1 Mar. 2016.

<http://www.unitconversion.org/unit_converter/concentration-solution-ex.html>.

⁵ "Conductivity Converter." *Lenntech Water Treatment Solutions*. Lenntech, n.d. Web. 1 Mar. 2016.

<<http://www.lenntech.com/calculators/conductivity/tds-engels.htm>>.

⁶ State of New Hampshire. Department of Environmental Services. *Hazard Identification for Human and Ecological Effects of Sodium Chloride Road Salt*. By Lori Siegel, Ph.D., PE. N.p.: n.p., 2007. Print.

Amy Elias '16

“Redox Stress Mediates PSGL-1 Induction During Latent HIV-1 Infection”

The greatest block to a cure for HIV is latent reservoirs. Discerning the mechanisms behind development, persistence, and eradication of latent HIV reservoirs is principal to finding a cure. Moreover, HIV patients must face the difficulty of HIV associated disorders as they age, such as HIV associated neurocognitive impairment. When latent HIV infected cells cross the blood brain barrier, they become immunoprotected and cannot be eradicated. To cross the blood brain barrier, monocytes must adhere to endothelial cells using several signaling and adhesion molecules. In order to investigate the phenomena of latently infected HIV positive monocyte adhesion to the blood brain barrier, the novel gasotransmitter, hydrogen sulfide, has been the focus of this investigation since it is an indirect read out of the transsulfuration pathway with novel implications. During this study, it is shown that latently infected HIV positive monocytes have a 69% reduction in hydrogen sulfide production compared to uninfected monocytes. Since hydrogen sulfide is a byproduct of the transsulfuration pathway, which produces glutathione, it is suggested that latency in HIV positive monocytes causes an altered redox state, which can be exploited for both detection and eradication of reservoirs before their entry into the CNS. Moreover, it was found by another member of the Maggirwar laboratory that PSGL-1 expression is increased during latent HIV-1 infection. Therefore, it is believed that this expression is increased due to an altered redox state. Current experiments will determine the mechanism of this reduction in hydrogen sulfide and increase in PSGL-1, quantify the levels of glutathione in uninfected and infected cells, and work to reduce monocyte adhesion and rescue an altered redox phenotype via pharmaceutical agents in latently infected HIV+ monocytes.

Justin Fraumeni '17

“MOTIVE: MANET Optimization Through Interaction, Visualization, and Evaluation”

Wireless ad hoc networks are infrastructure-less networks developed to meet the needs of a variety of applications where infrastructure-based wireless networks are difficult to deploy and maintain. The increasing

availability of mobile devices that naively support Device-to-Device (D2D) communication protocols allows for a unique opportunity to realize large scale ad hoc wireless networks. Gathering device and network information, presenting them in an easily accessible way and allowing user inter-action with the network is essential for efficient resource management of large networks. We propose a resource-monitoring framework for networks of mobile devices, and demonstrate an implementation of the framework on mobile multi-hop networks of Android devices.

Natalia Galant '16 & Danika Teverovsky '16
“Visualizing Population Model Responses of Peripheral, Brainstem and Midbrain Neurons to Complex Sounds”

Complex sounds are represented by the pattern of discharge rates across the population of auditory-nerve (AN) fibers. This representation is transformed as the information ascends the auditory pathway. There are several ways in which the fine-structure and envelope temporal properties are altered. At low stimulus frequencies ($< 600\text{-}700$ Hz), in the anteroventral cochlear nucleus (AVCN), the synchrony of primary-like response type neurons to the fine-structure of stimuli is enhanced, but at high frequencies their synchrony is reduced. Temporal envelope cues, or amplitude fluctuations, in the stimulus are encoded by fluctuations in the instantaneous discharge rates of AN responses. The neural representations of these envelope cues are shaped by narrowband filtering in the auditory periphery. The AN neural fluctuations are further shaped by nonlinearities such as rate saturation and synchrony capture. All types of AVCN neurons across all frequency channels have enhanced synchrony to the neural fluctuations. This enhanced synchrony to the neural fluctuations increases contrasts in the amplitudes of fluctuations across frequency channels. These contrasts set up differences in discharge rates at the level of the inferior colliculus (IC), where neurons are tuned to low-frequency fluctuations of their inputs. Visualization of these envelope-based contrasts for complex stimuli requires population responses of actual or model neurons. We have developed software to display the responses of the Zilany et al. (2014, JASA 135:283-286) AN model, and simplified models for AVCN and IC neurons (Carney et al., 2015, eNeuro 2:e0004-15). Contrasts in the fluctuations across frequency channels provide a basis for coding

complex sounds. Visualizing responses at several stages of the ascending pathway to stimuli from classic psychophysical studies provides insight as to the cues that are available to listeners based on neural fluctuations. We will illustrate responses to several stimulus paradigms including tones in bandlimited noise and notched-noise maskers, profile analysis stimuli, and stimuli with steep spectral slopes, such as those used in studies of edge pitch and pinna cues.

***Bethany Gardner '18, Anaclare Sullivan '18 & Tyler Trine '16
"Speaker-Specific Modulations of Real-Time Visual Search Behaviors
to Pragmatic Unreliability"***

We comprehend language by making inferences, but we still do not know how much of this is unique to specific speakers. Grodner and Sedivy (2011) built on previous eye-tracking experiments demonstrating contrastive inference. When shown images of a tall cup, short cup, tall pitcher, and key and told to "Click on the tall cup," subjects begin looking at the tall cup during the adjective ending. Without a contrast pair (plate replacing short cup), this does not happen until the noun ending, which implies that listeners predict that the adjective disambiguates between two contrasting possibilities (two cups) to deduce the noun before hearing it. Grodner and Sedivy manipulated the pragmatic reliability of the speaker (e.g. excessive adjectives), finding that contrastive inference was suspended when the speaker was unreliable. We performed a conceptual replication in Fall 2015 using recordings and pictures instead of an actor and props. While we replicated contrastive inference, the effects of speaker reliability were ambiguous; looking at the experiment as a whole showed that listeners make more contrastive inferences in the unreliable speaker condition, while splitting the data between earlier and later trials indicates that subjects decreased contrastive inferences as they observed more evidence about the speaker's unreliability. This semester we are extending the length of the experiment, changing cover story and audio data to make the unreliability more plausible, and adding a second unreliable condition to compare over- and under-informativity. This will allow us to refine what aspects of speech convey pragmatic unreliability, which has implications for future experimental designs, as well as contributing to theories about the speed and specificity of adaptation in language processing.

Jenna Glatzer '17

“SOX2 and Progenitor Proliferation in the Mammalian Inner Ear”

Auditory and vestibular disorders result from damage or death of critical inner ear cell types. These provoke permanent hearing impairments or balance difficulties, as mammals lack a biological replacement mechanism for these cell types following damage. The progenitors of these cells begin dividing in the otocyst, an early embryonic structure that undergoes massive proliferative and structural changes during the course of development. Knowledge of the molecular mechanisms by which critical cells normally proliferate in this period may be useful for replacement therapies aiming to regenerate these critical cells in vivo or in vitro after injury. One obstacle to this is the current dearth of information regarding how inner ear progenitors normally proliferate in mammals. The research outlined here aims to characterize and quantify cell proliferation in the embryonic mouse inner ear, which has not been previously examined. In efforts to understand the molecular events surrounding proliferation, we focused on SOX2, a critical gene for inner ear development and additionally for stem cell proliferation.

Importantly, its role in otic proliferation is unknown. To test the role of Sox2 in proliferation, we conditionally deleted SOX2 using an inducible-Cre mouse line crossed with a line carrying a floxed SOX2 allele. Samples were collected at embryonic day (E) 10.5 and processed for cryosectioning, immunohistochemistry, and were imaged with AxioVision Software. Proliferating cells were labeled using an antibody to phospho-histone H-3 (pH-3), a marker of dividing cells, and sensory areas were labeled using an antibody to SOX2. We observed broad SOX2 expression throughout the otocyst. Following this pattern, robust proliferation was also observed throughout the otocyst. Notably, in the SOX2-deficient mutants, the overall number of proliferating cells was significantly reduced. These results point to a novel role for SOX2 in inner ear proliferation. Understanding the role of this gene in proliferation during early embryonic events may yield crucial information for therapies to regenerate critical cell types.

Abby Haslinger '17

“Is Center-Embedded Sequencing the Limiting Factor of Language?”

It is widely believed that the ability to master recursion is at least one of the precursors to language. To date there has been no evidence that non-human animals can use center-embedded recursion, which is analogous to the use of phrase structure grammars (PSGs), in human language. In this study, we tested children (age 3-5 yrs.) and rhesus macaques for their ability to learn and apply center-embedded recursion. Subjects were given an ordering task in which they had to touch sets of brackets in recursive orders, and then transfer the strategy to novel stimuli. We found that children naturally use a center-embedded recursion to order novel lists. Although monkeys did not use center-embedded recursion at first, with additional training, monkeys used a center-embedded strategy more often than chance. Thus, although center-embedded recursion is not a natural ability for monkeys, they are able to learn it and generalize it novel stimuli after extended training. This suggests that recursion is not a uniquely human ability and is therefore not the limiting factor of language.

Julia Iourinets '16

“The Hippocampus Projects to Bed Nucleus of the Stria Terminalis but not the Central Amygdala Nucleus in Primate”

The bed nucleus of the stria terminalis (BNST) and central nucleus (CeN) of the amygdala are opposite poles of the ‘central extended amygdala’, a macrostructure that is known for its role in responses to aversive stimuli. In rodents, these two poles have differences in function, with the BNST required for long-lasting fear responses evoked by unconditioned stimuli, while the CeN is more involved in immediate fear responses and consolidation of conditioned stimuli. Even though the BNST and CeN are thought to have very similar inputs, we looked closely at hippocampal inputs to see if this projection could explain these subtle functional differences. Small injections of retrograde tracers were placed in the BNST and CeN and the distribution of labeled cells in the hippocampus was charted. Results were confirmed with anterograde injections into the hippocampus. BNST injections resulted in restricted but dense distribution of labeled cells in the rostral CA1’ of the hippocampus (the uncus). None of the CeN injections resulted in labeled

cells in the hippocampus. Anterograde studies confirmed these results. Thus, the BNST differs from the CeN in receiving direct hippocampal inputs, while the CeN receives only indirect hippocampal influence through amygdala-CeN pathways. Our data suggest that autobiographic and contextual fear memories are channeled directly to the BSNT, perhaps shaping long-lasting responses in conditions such as PTSD. In contrast, the CeN is likely more involved in immediate fear responses in the ‘here and now’.

Rebecca Joseph '17

“Assessing Nucleic Acid Binding Capabilities of HIV Host Defense Factor APOBEC3G Mutants”

APOBEC3G (A3G) is a nucleic acid binding protein and HIV restriction factor. A3G mutates the viral genome during reverse transcription through deamination of dC to dU, creating mutations that inactivate the virus. Previous studies indicate that the C-terminal catalytic domain of A3G is most important in ssDNA binding and deaminase activity. Cellular RNAs can also bind to A3G, but their binding displaces ssDNA and inhibits deamination of ssDNA by forming ribonucleoprotein complexes with A3G. Mass spectrometry mapping of A3G peptides cross-linked to nucleic acid suggested ssDNA only bound to three peptides: amino acids (aa) 181 to 194 in the N-terminus and aa 314 to 320 and 345 to 374 in the C-terminus that were part of a continuous exposed surface. RNA bound to these same peptides and uniquely associated with three additional peptides in the N-terminus. To investigate the role of two of these common regions in nucleic acid binding, point mutations were introduced within A3G peptides aa 181 to 194 and aa 314 to 320 to replace potentially active tyrosines 181, 182, and 315 for alanines. The corresponding A3G mutant proteins were expressed in a baculovirus system, and purified proteins were tested for ssDNA and RNA binding by gel mobility shift analysis and fluorescence anisotropy. Binding experiments showed that Tyr315 mutant lacks nucleic acid binding while Tyr181 and Tyr182 both bind nucleic acids less effectively than wild type A3G. In addition, Tyr315 mutant showed no cytidine deaminase activity in a reporter *E. coli* mutagenesis system and Tyr181 and Tyr182 had only partial activity as compared to the wild type A3G. Our data demonstrated that all three tyrosine positions are

important for A3G nucleic acid binding with Tyr315 being the most essential.

Md. Tanveer Karim '16

“The Rotation Period Distribution of 4-10 Myr T Tauri Stars in the Orion OB1 Association”

Most existing studies of young stellar populations have focused on the youngest (< 2-3 million years old) T Tauri stars, which have not started fusing hydrogen to helium, and are usually associated with their natal gas. In contrast, older T-Tauri stars (~ 4-10 million years old), are located in regions where their parent gas and dust clouds have long since dissipated, and therefore are more difficult to find; as a result they have been less studied. However, because important physical processes are expected to take place during this later age range, these slightly more evolved young stars are key to our understanding of aspects like the angular momentum and protoplanetary disc evolution of lower-mass (0.1-2 Solar Mass) stars. We present a study of photometric variability of 1974 confirmed 4-10 Myr old T-Tauri stars in the Orion OB1 association using optical time-series from three different surveys: the Centro de Investigaciones de Astronomia-Quest Equatorial Survey Team (CIDA-QUEST), the Young Exoplanet Transit Initiative (YETI) and from a Kitt Peak National Observatory (KPNO) campaign. We investigated stellar rotation periods according to the type of stars (Classical or Weak-lined T Tauri stars) and their locations, to look for population-wide trends. We detected 563 periodic variables and 1411 non-periodic variables by investigating the light curves of these stars. We find that ~ 30% of Weak-line T-Tauri stars (WTTS) and ~ 20% of Classical T-Tauri stars (CTTS) are periodic. Though we did not find any noticeable difference in rotation period between CTTS and WTTS, our study does show a change in the overall rotation periods of stars 4-10 million years old, consistent with predictions of angular momentum evolution models, an important constraint for theoretical models for an age range for which no similar data existed.

Nicole Kase '18 & Erin Muir '18

“‘We are less and less’: The Diminishing Self-efficacy of Youth in an Alpine Community”

Alpine communities throughout Italy are in decline. A major component of this decline is a demographic landslide, or an out-migration of youth. Youth are vulnerable to the threat of unemployment, drugs, alcohol, and lack of social networks and activities, all of which are factors that contribute to the high levels of emotional distress. Statistics from the province of Belluno, in which Borca resides, show an unemployment rate of 28.4% with youth having 42% unemployment. Furthermore, suicide rates in Belluno are 11.7/100,000 compared to the national Italian suicide rate of 5.1/100,000 (“Provincia di Belluno”). These rates illustrate the distress in the province and the unique pressure youth face. Using the Health Belief Model and the concept of self-efficacy to frame our study, we sought to understand the perspectives of youth (ages 21 to 30) on the sources of emotional distress in one such Alpine village, Borca di Cadore. The Health Belief Model has four key components, including perceived severity of the threat, perceived susceptibility, perceived benefits, and perceived barriers to changing. The concept of self-efficacy is the perception a person has of his or her own capacity to make a desired change. This construct would increase our understanding of why youth suffer and what can be done to promote community healing. Through a community engagement approach, we immersed ourselves in the life of the village, organized participant observations, and conducted interviews. The interviewees were diverse in age, sex, and occupation. Many of them cited youth as being the most susceptible generation to emotional distress. Additionally, there exists a generational gap between the youth and the elderly in which both feel challenged to understand the other. Youth feel they have little control to change these factors within the walls of the community and are forced to leave if they seek employment or higher education. This perceived lack of control diminishes their self-efficacy-- leaving them feeling helpless and isolated. The largest perceived barrier is the stigma in the community for those experiencing mental health distress. This lack of positive dialogue and the shame that accompanies it, disincentivizes people from sharing their troubles--whether it be with family members, friends, or psychologists at the new mental health clinic. Yet many interviewees believe that if sharing and openness were to occur,

especially between the old and young generations, it would immensely benefit the youth who suffer.

Lauren Kemperman '17

“Web Application to Assess and Compare Competing microRNA Quantification Algorithms”

In my research, I have worked with benchmark data and software developed primarily by Matthew McCall that assess and compare performance of microRNA expression estimates. I have contributed to this project by using a web application framework to develop another tool for the assessment and comparison of competing algorithms. The web application makes comparisons possible that cannot easily be made by just using the software package. I have developed features that allow users to visualize comparisons, and choose quality thresholds for data and visualize the effect of expression estimates. The goal of the overall project is to facilitate the development of new methodology for microRNA expression estimation. The addition of the web application to Matthew McCall’s package is notable and helps accomplish that goal using some of the tools I have described to make relationships and comparisons clearer through visualization, but also because it is accessible to non-R users, and provides a space for people to share their expression estimates with the scientific community.

Richard Ladley '16

“Studies toward the total synthesis of the immunosuppressant FK-506”

FK-506 is a 23-membered macrocyclic lactone isolated from the fungus *Streptomyces tsukabaensis* by Kino and co-workers at the Fujisawa Pharmaceutical Company in 1984. It belongs to a class of immunosuppressant natural products alongside of cyclosporine A and rapamycin that interrupt cellular signaling pathways leading to T-cell activation, leading to immunosuppressant qualities. Our total synthesis of FK-506 revolves around the late-stage installation of an allyl group critical to the biological function of FK-506. Herein, we present several studies and optimizations of various reaction schemes in preparation for the total synthesis of FK-506. These include the scaled preparation of a dioxinone phosphonate ester moiety, an oxazolidinone-auxiliary

approach to a chiral aldehyde intermediate, and the synthesis of a chloroacetate precursor to a separate aldehyde coupling partner. Optimization of these steps and others will assist in the compiling of key intermediates for use during the construction of the molecular scaffold of FK-506.

Madeleine Laitz '16

“Toxicology and Environmental Prevalence of Rare Earth Elements”

The Rare Earth Elements (REE) are the string of fifteen elements from atomic number 57 to 71, otherwise known as the lanthanide series, as well as Scandium and Yttrium, atomic numbers 21 and 39 respectively. These elements are dubbed “rare” not because of their scarcity, rather their disinclination to form ore deposits. The REEs are fairly easy to find, and exist in reasonable abundance. REEs and indium production have increased dramatically with the rising demand for electronics, as these elements, though used in small quantities, play an invaluable role in the function of new technologies. In the iPhone alone, nine REEs are required to make the phone slim and powerful (Figure 1). With the exponentially increasing production of the electronics and green technologies in which REEs are found, conducting a comprehensive analysis of their toxicity is critical. At this point, little research has been done on the effects this increase in production might have on the population, and what findings do exist are often contradictory. Hirano and Suzuki (1996) claim that the toxicity of lanthanides decreases with increasing atomic number, while Bruce, Hietbrink, and DuBois (1963) found that compounds displayed an increase in toxicity with increasing atomic weight. It is also necessary to obtain an understanding of the prevalence of REEs in the environment, as preliminary studies have revealed chronic exposure as a potential health hazard. Even low concentrations of these elements in the environment could prove harmful, and it is best to understand the risks of increasing the background concentration before technology production soars to unprecedented levels. This study provides a comprehensive analysis of background levels and semi-industrial REE concentrations as well as preliminary toxicity studies in human lung epithelial cells.

Valerie Langlois '16

“Feature Saliency and Availability of Alternatives in Rational Language Comprehension”

Successful communication between people in a conversation often requires the people who are listening (listeners) to make inferences based on the intentions of a speaker. For example, if a speaker wanted to point out a particular car in a parking lot, they could either describe it by color or by model. However, if all of the cars in the parking lot were red, it would make little sense to rely on color to distinguish between the cars. In this same line of thought, we investigated how speakers and listeners produce or interpret these kinds of referring expressions (utterances that pick out unique individuals (referents)) in variable contexts. In a set of experiments we divided participants were into two conditions: a Shape Condition and a Feature Condition. In the Shape Condition, we replicate a previous finding regarding the type of productions or inferences people make with items that vary in shape and feature. In the Feature Condition, we compare the findings in the Shape Condition to the kinds of productions and inferences people make when items vary across multiple feature dimensions. The results showed that participants responded differently in the two conditions, suggesting that they are willing to consider differences across multiple dimensions of features to be alternatives to one another, but not shapes and features. Later follow-up studies will look at whether the role of the compositionality of features, the ability to name the feature or object, or an interaction of the two plays a part in how listeners infer from a speaker's word choice.

Julian Nin '16

“The Effect of Rebalancing Hippocampal Pathways in Mice”

Numerous studies have provided evidence for the Hippocampus (HPC) being instrumental in tasks associated with spatial memory and navigation. The entorhinal cortex (EC), considered the primary interface between the hippocampus and the neocortex, contains grid cells, which are instrumental in navigation, requiring internal cues to update a representation of oneself in space. The accumulation of these cues, or path integration, is thought to be the primary source of information maintaining and updating grid field. Though there are a number of

proposed models of how the EC integrates information, and it is apparent that navigation appears to require a specific balance of inputs, not much is known about how this balance is important for navigation. Our study seeks to learn more about these pathways by manipulating the balance of inputs from the EC into the HPC. Using injections of Clozapine-N-Oxide (CNO) and phencyclidine (PCP) on transgenic mice containing Designer Receptors Exclusively Activated by Designer Drugs (DREADDs), we tested the effect of manipulating inputs from the entorhinal cortex to the HPC on behavior in a navigational memory task. No consistent behavioral differences were observed in navigational ability in the test subjects, but a foundation has been laid for further investigation, which may lead to a much richer understanding of what pathways are involved in navigational tasks and how they function.

Chiziterem Onyekwere '17

“A Brief Exploration into the Needs of Human Trafficking Survivors within Monroe County Pre-Trial Services”

Within the traditional criminal justice system, the motivations behind the offenses of human sex trafficking survivors charged with prostitution are rarely investigated. Human sex trafficking survivors are first victimized by their trafficker, their clients, and then by the judicial system that allows for the cycle of crime to continue¹. Through incarceration, they are punished for their nonconsensual involvement in a criminal act instead of being provided alternative to their current means of economic stability. This project examined the means of assistance and the efficiency of Pre-Trial Services, a system that aims to address the needs of human trafficking survivors. With the collected data, the study intends to revise the methods used in order to counsel the overcoming of institutionalized oppression and promote reintegration. Focus groups, word association lists, and questionnaires measuring self-esteem, feminism, and normalization of domestic violence were used to investigate the attitudes and experiences of the survivors and the Pre-Trial employees. During focus group sessions, both employees and human trafficking survivors were asked about the following: their experience within Pre-Trial Services, and the court system, along with their opinion of a recently launched Promote Health Application, the name “Human Trafficking Court,” and motherhood. Preliminary data indicate both groups hold adverse attitudes toward the structure of the

court system concerning privacy and respect, and identify motherhood as motivation to hinder recidivism. From the focus groups, hope, self-care, support, and motherhood were identified as principle themes. The perceptions of the human sex trafficking survivor population are scarcely seen within the literature and warrant future research. The efficiency of the Pre-Trial system and the attitudes of the human sex trafficking population can be utilized as tools to better promote successful rehabilitation.

Rosa Park '17

“Using Tandem Mass Spectrometry to Identify the Oxidative Stress-Induced Phosphoproteome and Ribosylome of Human Foreskin Fibroblasts”

Of the seven mammalian homologs of the yeast Sir2 deacetylase, Sirtuin-6 (SIRT6) is a chromatin regulatory factor that functions as an NAD-dependent histone deacetylase and a mono-ADP-ribosylase. Whereas SIRT6's deacetylase activity has traditionally been aimed at lysine histone substrates and is therefore associated with gene regulation, the biological significance of its mono-ADP-ribosylase activity is less well understood due to a paucity of identified *in vivo* substrates. The Gorbunova/Seluanov lab previously found that SIRT6 stimulates double strand break repair under conditions of oxidative stress by mono-ADP-ribosylating poly-ADP-ribose polymerase 1 (PARP1). A stimulatory effect of paraquat on SIRT6's interaction with PARP1 led us to hypothesize that there may be other substrates that are mono-ADP-ribosylated by SIRT6 under conditions of oxidative stress. To test this hypothesis, tandem mass spectrometry was used to analyze the TiO₂-enriched phosphoproteome and mono-ADP-ribosylome of paraquat-treated primary human foreskin fibroblasts that were immortalized with telomerase (MJT cells). In addition SIRT6 pull-down assays using both monoclonal and polyclonal antibodies against SIRT6 were conducted to test for the SIRT6-interacting proteins when the MJT cells were treated with paraquat. Proteins common to both the TiO₂ enrichment and SIRT6 pull-down experiments would be likely candidates for SIRT6's mono-ADP-ribosylation activity. In the TiO₂ enrichment experiments, we identified a ribosylated peptide from AMPK-1-alpha, a master regulator of the cell's response to nutrient status/energy state. These results

provide support for a potentially metabolic function of ADP-ribosylation and the possibility of SIRT6-mediated regulation of AMPK.

Katherine Peterson '16

“Geometry and Kinematics of the Northern Malawi Rift System”

Little is known about the initiation of rifting and the evolution of early-stage rifts, especially concerning the origin and role of magma during earliest rifting, the formation and evolution of rift segmentation and its manifestation at depth in the crust and lithosphere, and the temporal style of deformation. The ongoing SEGMeNT project aims to understand the weakly extended Malawi Rift, Africa, including characterizing deformation and magmatism in the crust and mantle lithosphere along 3 ca. 100 km-long rift segments bounded by large offset normal faults. The objective of this study is to determine the distribution and kinematics of crustal earthquakes in these two basins, and to use the results to test models for rift fault geometry and along-axis linkage. We analyze P-wave and S-wave first arrival data from a network of 52 broadband (60 s-100 Hz) seismometers deployed along the flanks of the water-filled rift basin. We have a growing catalogue of ca. 500 earthquakes with hypocentral depths ranging from 1 km to 47 km (± 0.6 to 11 km), for 111 well-located earthquakes within the array. The database includes a shallow Mw 5.0 earthquake and its aftershocks. These data represent the first systematic study of earthquakes in the region. Unlike other parts of the Western Rift, few Malawi rift earthquakes have hypocentral depths > 25 km, and the magmatic province is largely inactive. Focal mechanisms of the frequent earthquakes recorded across the array are spatially variable, and indicate oblique normal slip along steep faults. Results provide information on the thickness of the elastic crust, basin structure, and inform earthquake hazard mitigation programs in Malawi and Tanzania.

Pedro Piñera '16

“Perceptions about the Built Environment”

Architecture is a slow medium. Unlike cinema, radio, or even sculpture or painting, architecture's message is almost always abstract, largely inconspicuous, and incapable of enforcing direct meaning.

Architecture's message exists however. It is embedded in the space,

form and order that integrates the totality of our built world. No other space has a more relentless influence than that of our own personal room or studio. Though we adjust it to our needs, decorate it, and fill it with our objects, the order and form of the space within our room prevail, slowly building an affect only understood instinctively by our body, and unconsciously by our mind. Through this artistic experiment, my goal was to guide four college students through a method of passage from a routine-based, passive experience of their room—their most intimate space—to a more conscious and critical understanding of it, and the ways in which architecture shapes human bodies and minds. This was done through an increasingly defamiliarizing mediation of their room that slowly revealed the essential space they inhabited. It is only with a critical eye that we can identify, and help build spaces, forms and order that encourage the very long term freedom, creativity, and cooperation needed so much in today's society.

Emily Prentiss '16

“The Role of the Parvocellular Pathway in Fast Visuomotor Updating”

Speeded reaches to a visual target are subject to distortion effects when distractors are presented spatially adjacent to the target. Understanding the spatial and temporal constraints to which visuomotor updating is subject is central for understanding how the dorsal visual pathway functions, as well as the sensitivity of this pathway to certain classes of stimuli. Prior work has determined the relative sensitivities of different cell types within these pathways, specifically, parvo- and magnocellular cells. However, the relative contributions of these projections in fast visuomotor updating remains unclear. We exploit the fact that P-cells show red/green color opponency, which is not present in M- cells, to test to what extent parvocellular-projecting pathways are involved in fast visuomotor updates. Here, we present participants with a pointing task in which they must make in-flight corrections during movements to high-contrast-achromatic, or isoluminant-red-and-green stimuli, in order to target magno and parvocellular projections, respectively. Participants were asked to fixate on a target presented in 1 of 3 possible locations (1 center, 2 peripheral). Upon fixation of the target and initiation of the reach, targets either remain static, change position mid-movement, or remain static but with a transient distractor stimulus presented to one of

the other locations. Participants were asked to move as quickly as possible to touch the original target location, resulting in an average total movement time of about 350ms per trial. Overall, we observe that reach trajectories are biased toward distractors under all conditions. In healthy participants, we expect to see a diminished bias and/or delayed deviation toward distractors in the isoluminant-red-and-green condition. With this paradigm in place, by changing stimulus features of the targets against the background, we can elucidate the role of different visual pathways in supporting fast visuomotor updating.

Gabryella Pulsinelli '16

“Media and the Environment: How Can Visual Representation Teach us about Climate Change”

Climate change is a major issue according to 97% of scientists (John Cook, 2013) yet it is still a debated topic on news channels. According to sources, 1 in 4 Americans believe climate change not to be an issue (Saad, 2014). This may be because the main causes of climate change are invisible and are hard for Americans to grasp (Elke U. Weber, 2011). An image of a polar bear on small block of ice does not help ones understanding of the real consequences of climate change.

Communication of the science behind climate change is a huge factor in how people understand climate change. Yale conducted a study in which they had American adults take a quiz of their knowledge of climate change. Out of everyone who participated 52 percent of them failed. This is disturbing as half of Americans either are wrongly informed about climate change or are not informed at all (Leiserowitz, 2010). I hypothesize that people are likely to respond to an accurate visual representation that describes climate change. If climate change can be visualized than ones understanding will be more comprehensive.

Angela Remus '16

“Legal Testimony, Literary Testimony, and the Question of Truth”

This project, completed as part of a Spanish honors degree thesis, explores the different presentations of personal narratives in *testimonio* and the personal narratives compiled by truth and reconciliation commissions (TRCs). To some extent, both *testimonio* and TRC testimonies serve a similar purpose: the voice of one individual tells a

story that is shared among a collective of victims. However, there is little academic literature exploring the relationship between the two types of testimonies. Using *Testimonio: Muerte de una comunidad indígena* by Víctor Montejo and *Memoria del Silencio*, the report created by the Guatemalan Commission for Historical Clarification, my project will explore the linkage between two types of testimony: literary testimony and legal testimony. I argue that, rather than privileging one form over the other, the claims to truth made in each are complementary: studying the texts together offers a fuller picture of the violence of the period than either can alone. TRC reports are not pure, factually accurate representations of “truth,” as they are sometimes interpreted; their hegemonic narrative obscures important details. Testimonial literature adds nuanced and personal “truths” not included in TRC reports; their ability to communicate ambiguity and personal reactions reflects what many lived during periods of conflict.

Tarin Rickett '18

“Navigating Uncertainty and Confidence: An Investigation into our Perceptual Decision-Making”

Confidence in our abilities guides our choices. When we consider factors which may impact our confidence, we intuitively think of prior experiences and what we have learned from them. However, the effects of our previous successes and failures on confidence have not yet been explored in an experimental setting. In our study, we investigated whether positive or negative performance during a perceptual matching task affected subjects’ confidence in future trials of perceptual appraisals. Subjects were presented with a noisy Gabor patch and asked to report whether the patch was oriented right or left. Subjects then decided whether or not to “bet” on the task, winning 5 cents for a success and losing 5 cents for a failure. Subjects also had the option to skip the task for the cost of 1 cent. We expect that subjects will be more likely to skip trials after negative feedback. We also expect to see slower rates of learning follow multitudes of positive feedback. This may give us valuable insight into how we make and evaluate decisions based on our previous performance.

Rabi Shrestha '16

“Terahertz Spectroscopy of Graphene-Polymer Nanocomposites”

Terahertz time domain spectroscopy (THz - TDS) is a non-destructive form of spectroscopy, which utilizes THz waves to measure the electrical and optical properties of objects with sub-picosecond resolution. THz radiation lies in the spectra between infrared waves and microwaves; it lies in the spectra between the optical and electrical waves. As such this is a field which still has a lot to be researched and shows a lot of promise. The advantage of THz spectroscopy compared to conventional spectroscopy, is that it measures the amplitude and phase of the THz electromagnetic field. This allows for the calculation of such parameters as index of refraction and absorption coefficient, electric permittivity and conductivity. This method is being utilized in the lab, to characterize the properties of graphene-polymer samples. The real life application of THz are wide and can range from use in security (such as the THz scanners in airports) and in the medical field, where THz radiation has been used to find cancerous skin cells. The subject being tested, graphene polymer nano-composites, are also equally interesting because these products are relatively new in the field and show several characteristics to carbon nanotubes. The research being conducted will lay a foundation for further samples, similar to the nano-composites, being tested through THz-TDS. In addition, the graphene polymer nano-composites could have potential in having a real life application in the medical field.

Andrew Stern '16

“Ultra-High Responsivity of Optically-Active Semiconducting Asymmetric Nano-Channel Diodes”

Here we present our research on fabrication and optical characterization of novel semiconducting asymmetric nano-channel diodes (ANCDs). The ANCD, also called the self-switching diode (SSD) is fundamentally a new type of semiconductor nanodevice that develops its nonlinear current-voltage (I-V) curve relying on the asymmetry of the fabricated structure and ballistic transport in a nanometer-width 2-dimensional electron gas (2DEG) channel. Based on Monte Carlo simulations, ANCDs are expected to be powerful, tunable THz generators, and have been demonstrated to be viable THz detectors. In this work, we are

focused on new optical properties of ANCDs and demonstrate that they can be operated as very sensitive, single-photon-level, visible-light photodetectors. The ANCD I-V curves were collected by measuring the transport current both in the dark and under 800-nm-wavelength, CW laser light illumination. Although the nanochannel of our devices remained conducting even at zero bias, the impact of the light illumination was very clear, and we observed a substantial photocurrent even for the incident optical power as low as 1 nW. Most interestingly, the magnitude of the device responsivity increased linearly with the decrease of the optical power over many orders of magnitude, reaching the value of almost 10,000 at 1-nW excitation. The latter gain factor is comparable to the gain of avalanche-type photodetectors.

Nicola Francesco Tavella '17

“Analyzing the GBF’s Role in Accessorizing Gay Men and Reinforcing the Peter Pan Syndrome”

A rapid social shift towards a more overtly accepting public has given rise to a trend that replaces outright homophobia with hidden discrimination. Acceptance, now an option, becomes a weapon used conditionally by the heteronormative system to integrate queer people into mainstream society without dismantling homophobia. The trend to which I am referring is the Gay Best Friend (GBF) phenomenon. As a queer man myself, and having experienced this phenomenon firsthand, I felt compelled to use my personal experience to guide an objective research project that hoped to tease out how the GBF came to be, how it is reinforced, and what its effects are. To research this topic, I analyzed representations of the GBF in a variety of television shows from *Sex in the City* to *My So-Called Life*, and compared these representations to social constructionist theories from such authors as Rictor Norton and bell hooks. I also incorporated a popular YouTube series centered around a GBF character that sheds light on how this trend has developed. Ultimately I found that the GBF phenomenon not only reinforces a heterosexual dominance over a queer minority, but also interweaves with racist and classist ideas. Gay men relegated to the GBF category end up missing out on their own adolescence, which contributes to Dan Kiley’s infamous Peter Pan Syndrome, seen so commonly in older gay men. What I concluded from my research is therefore that, despite wildly different from the blatant homophobia of

an earlier time, the GBF phenomenon has similarly detrimental effects on the queer community. More research is undoubtedly needed to continue analyzing this topic, but I think that my research thus far can attest to such conclusions.

Jing Wang '16 (Take 5 '17)

“Intravital Xenopus Tadpole Model for Investigating the Blood Brain Barrier (BBB) Function During Inflammation and Viral Infection”

Evidence suggests that infection of the amphibian *Xenopus* by the pox-like ranavirus Frog Virus 3 (FV3) triggers inflammation and alters the Blood Brain Barrier (BBB) integrity, which leads to viral dissemination into the tadpole brain but not in the adult brain. However, it remains unclear how critical monocytic phagocytes are in the dissemination of FV3 into central nervous system (CNS) through BBB leakage. Our data showed that the FV3 infection alters the BBB integrity, and fluorescence markers of early viral infection were detected both in kidney and CNS of tadpoles. Based on our hypothesis that macrophages play a major role in viral dissemination by carrying the virus into the CNS, it is anticipated that macrophage depletion in tadpole will decrease viral infection in the brain.

Alicia Wei '18

“Optogenetic Control of ROS Production in *C. elegans* using CRISPR/Cas9 Fusion Proteins”

Reactive Oxygen Species (ROS) can be detrimental or may lead to beneficial adaptive responses. The factors that distinguish between these outcomes are not readily determined using existing techniques. Here, we have developed a novel *C. elegans* model to study the effects of ROS in a physiologic context using a combination of CRISPR/Cas9 gene editing and optogenetics. Mitochondria are a main source of ROS and are central to cell death and adaptation to stress. We used cutting edge genetic techniques to fuse components of the mitochondrial respiratory chain to proteins that can produce ROS in response to light. MiniSOG produces singlet oxygen, which has the singular capacity to illicit damage, while SuperNova creates superoxide, which we predict may be beneficial in limited amounts. We fused miniSOG to complex II of the mitochondrial respiratory chain in *C. elegans*. The strain exhibited light-

sensitive loss of complex II activity and the worms exhibited adverse reactions to light under conditions of mild stress such as, paraquat, an ROS generator or FCCP, a protonophore. In contrast, the strain expressing the SuperNova fusion had no adverse reaction to light and the conditions of mild stress when coupled with light. Future experiments will be necessary to determine whether light is in fact beneficial in this strain, as we hypothesize. With these constructs, we will be able to study the complex II of the mitochondrial respiratory chain ROS microdomains.

Alexander Weinstein '16

“Seismicity Patterns around Oldoinyo Lengai and Gelai Volcanoes, Africa”

Early-stage continental rift zones provide important insights into the deformation behavior of crust and mantle lithosphere, and its modification by the migration of magma and volatiles. The Magadi-Natron-Manyara rift zone in East Africa includes several intrabasin volcanoes, including two active volcanoes separated by ca. 25 km: Oldoinyo Lengai (carbonatitic) and Gelai (shield). We use a catalogue of 3302 earthquakes of $1 < ML < 5.1$ recorded on a 39-station seismic array spanning three rift segments (Magadi-Natron-Manyara) of the Eastern rift, Africa to determine possible fault interactions with tomographically imaged magma conduits and reservoirs beneath active and dormant volcanoes. We focus on swarms of earthquakes beneath Oldoinyo Lengai volcano, which last erupted in 2007-8, and Gelai volcano, which had a major dike intrusion in 2007, and the 30 km-wide zone between the two volcanoes, using cluster analyses and earthquake focal mechanisms. Earthquake focal mechanisms are predominantly NS-striking normal faults with steep dips from near surface to 25 km in the Natron and Magadi basins, whereas the strike of normal faults locally rotates to N60E in the basin segment with the two active volcanoes. This rift-oblique structure links the Manyara border fault to Gelai shield volcano via Oldoinyo Lengai volcano, and may be a zone of magma and gas transfer. The results of this study can provide insight into the role of magmatic intrusions in rift zones and provides a basis for hazard mitigation strategies in the area.

Eugenia Zeng '17

“A Novel Mechanism Linking Sympathetic Nervous System Activation and Cancer Progression; Beta-adrenergic Receptor Regulation of Cancer-Derived Exosomes”

Emotional stress arising from breast cancer diagnosis and treatment can enhance tumor growth and metastasis by activating one of the canonical stress response pathways, the sympathetic nervous system (SNS). SNS activation elicits the release of the neurotransmitter norepinephrine (NE) that activates target cells expressing β -adrenergic receptors (ARs). All cell types secrete a population of small, extracellular vesicles, known as exosomes that have been shown to play a role in cell-cell communication. In cancer cells, exosomes have been shown to foster tumor growth and progression. Interestingly, both the SNS and exosomes have separately been shown to increase tumor-associated macrophage (TAM) populations, suggesting that in tumors, β -AR signaling may regulate TAMs via release of tumor cell-derived exosomes. **We propose the hypothesis that β -AR stimulation alters the number, content, or function of exosomes secreted by cancer cells.** We will test exosomal function by measuring tumor-promoting cytokines by macrophages in vitro. To test the hypothesis, R221a cultured breast cancer cells will be treated with medium or with isoproterenol, a non-selective β -AR agonist. Exosomes released by tumor cells treated with isoproterenol or medium alone will be evaluated by Nanosight particle tracking analysis to determine exosomal concentration and biophysical characteristics. To measure exosomal functional activity, exosomes will be added to Raw264.7 cells, a transformed macrophage cell line, and protein content will be analyzed by flow cytometry. Cytokines and chemokines constitutively produced by Raw264.7 cells will be quantified using a multiplex immunoassay. Finally, potential exosomal mediators of altered macrophage cytokine production will be tested using neutralizing antibodies. This investigation will reveal a novel pathway through which stress can impact tumor cell-macrophage interactions to increase tumor growth and progression. By mechanistically characterizing this novel stress/cancer progression pathway, we will identify novel therapeutic targets to block the impact of SNS activation in cancer.

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