Highlights of Undergraduate Research

Summaries of selected research projects presented at Ohio State’s 18th annual Denman Undergraduate Research Forum
With this booklet, we are excited to showcase some of the fascinating research projects that Ohio State students have completed outside their normal course work. Working with faculty, graduate students, peers, or independently, these talented and highly motivated students are an inspiration to the entire university community.

Each spring, several hundred undergraduates in all fields of study present their work at the annual Denman Undergraduate Research Forum, now in its 18th year. Here, you will find a selection of projects from the 2013 forum. We invite you to browse these pages to see the excitement, value, and diversity of these scholarly contributions. This is only a brief introduction to the types of research our students are working on—a list of all student projects from this event, along with descriptive abstracts, is available at the Denman Forum website, denman.osu.edu. You also can find undergraduate research theses at Ohio State's Knowledge Bank, kb.osu.edu.

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Andrew Muehleisen, right, shares his findings with advisor Simon Queenborough

Undergraduate Research Office
53 W. 11th Ave.
Columbus, OH 43210
uro@osu.edu • 614-292-8307
undergraduateresearch.osu.edu
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Progressive collapse is a structure’s partial or complete failure following the loss of a support element. By understanding it, we can better prepare for progressive collapses that might occur from explosions, driving accidents, and other forces. For my honors thesis, I analyzed the effects of removing a column from a steel building, Haskett Hall, which stood on Ohio State’s campus from 1925 to 2011. I investigated such questions as whether computer programs can accurately model the behavior of pre-existing buildings; whether current technology and instrumentation methods effectively capture a building’s response to column removal; and whether steel building design guidelines are valid for potential progressive collapse scenarios.

To measure the building’s structural response to the column removal, graduate students and I outfitted connecting beams and neighboring columns with strain gauges and displacement sensors. I then created a two-dimensional computer model. After comparing the experimental and theoretical data, I concluded that while the two-dimensional analyses suggested the building would fail, three-dimensional analyses were needed for accuracy. Witnessing the demolition was incredible. It’s so rewarding to know that my project will contribute to future research and possible design methods in the field. I also loved presenting my research at various forums, including the Denman, and witnessing others becoming excited by the project, even as I gained a better understanding of it myself.

**Project title:** Progressive Collapse Testing and Analysis of a Steel Building

**Advisor:** Halil Sezen

**Honors:** Honors & Scholars Summer Undergraduate Research Scholarship; honorable mention, Denman Undergraduate Research Forum

**What’s next?** Ebiji will continue this research project while pursuing his master’s degree in structural engineering (civil engineering focus) at Ohio State.
By now, it's widely known that diet is an important factor in regulating the development of diseases such as cancer. Black raspberries are a great example of a “superfood.” However, despite the data showing that black raspberry derivatives inhibit cancer cell growth, we do not know the immune mechanisms by which they act. That's where my project comes in.

I worked in the lab of Dr. Gregory Lesinski. We hypothesized that an ethanol extract from black raspberries or its metabolites would reduce the inflammatory changes that promote tumor development by altering myeloid-derived suppressor cells, or MDSCs. These immunosuppressive cells promote cancer, which is why black raspberries’ ability to prevent their formation helps fight the disease. To study how the black raspberry extract alters them, we used a technique to generate MDSCs in vitro from human donor blood. We found that adding black raspberry derivatives to the cells prevented them from differentiating into MDSCs. We also determined a mechanism by which this inhibition could occur. STAT3 is a transcription factor whose activation as pSTAT3 can promote inflammation, including differentiation of MDSCs. Using western blot, we found that black raspberry derivatives inhibited pSTAT3. In order to expand our understanding of these modulatory effects, we plan to investigate how black raspberry extract affects alternative cell signaling pathways. Black raspberry has the potential to be used in dietary intervention or drug development. Scientists could apply the immunomodulatory effects of black raspberry to numerous diseases, such as cancer and autoimmune conditions. For example, the inhibition of MDSCs by black raspberry could be directed to help inhibit the immunosuppression that occurs in carcinogenesis.

It was neat to see the progression from studying the whole black raspberry extract to investigating the individual metabolites.

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**Project title:** Effects of Black Raspberry Derivatives on Myeloid Cell Differentiation

**Advisor:** Gregory Lesinski

**Honors:** Pelotonia Undergraduate Research Fellowship

**What’s next?** Zeenath will attend The Ohio State University College of Medicine in fall 2013.
Despite the ongoing quest for alternatives, fossil fuels remain our predominant energy source, even as their combustion results in major environmental pollution in the form of greenhouse gases, namely carbon dioxide (CO$_2$). But if we consider harnessing the CO$_2$ itself as an energy source, the environmental cost may not be so daunting. So, in my research, I use electrochemical techniques on nanoporous copper metal, that use electricity, like the electricity or voltage used to charge a phone battery and Raman vibrational spectroscopy, which provides a readout or spectrum similar to an EKG readout. These techniques work in concert to convert and monitor the conversion of CO$_2$ to more beneficial chemicals.

Nanoporous copper metal catalysts have been found to produce many useful compounds from the electroreduction of CO$_2$. Electroreduction converts CO$_2$ by using electricity to remove the oxygen in CO$_2$ so that new compounds can be formed. By measuring CO$_2$ conversion in-situ, other lab members and I can figure out how that conversion works and improve the process by constructing new catalysts. Ultimately, the goal would be to integrate CO$_2$ utilization into the energy infrastructure to better meet society’s environmental and energy needs. For example, atmospheric CO$_2$ could be used to make formate (HCOO$^-$) or ethylene (C$_2$H$_4$), which can be used as fuels or feedstocks, or stored as liquids—simultaneously removing CO$_2$ from the atmosphere and turning it into an energy source.

The most exciting aspect of my research as a member of Dr. Anne Co’s lab has been the freedom to do real scientific work and learn techniques and instrumentation that are usually reserved for higher-level scholars.

**Project title:** Investigating and Identifying the Electroreduction Pathways of Carbon Dioxide via Vibrational Spectroscopy

**Advisor:** Anne Co

**Honors:** Arts and Sciences Undergraduate Research Scholarship

**What’s next?** Chib intends to go to graduate school in chemistry or pharmacy.
From fast food menus to smartphone screens, video technology is infused into everyday life. Our project explored how technology can be integrated into a dance performance, titled “Staring at the Sun.” We captured video of dancers in Columbus parks and projected them on three screens around the performers in the Experimental Media and Movement Arts lab (EMMA) at the Advanced Computing Center for the Arts and Design. While the audience was in close proximity to the performers, the media created a distinct setting that the audience could merely observe. The dancers on screen and on stage acknowledged this separation between performer and audience through eye contact and spatial relationships.

In addition to creating the environment, the video related to the live dance in many ways, which was part of the purpose of our work: while many performances incorporate video, they often lack a strong connection between live movement and video. We wanted to establish that connection. Close shots of the dancers’ faces gave the audience a feeling of intimacy with the performers that contrasted with the dancers’ intense physical movements. Sometimes the live dancers’ spatial patterns reflected the camera motion to heighten the audience’s engagement with the performers, while at other times, the video and live pacings were juxtaposed to create contrast and unevenness. The result was a performance both personal and distant.

We collaborated on all aspects of the project, from developing the idea to performing it. It was exciting to see how the video influenced our choreographic decisions—we worked in a constant feedback loop that allowed live dance and video to complement one another.

**Project title:** Video and Live Dance in Symbiosis

**Advisor:** Susan Hadley

**Honors:** Undergraduate Research Scholarships from the College of Arts and Sciences

**What’s next?** Quentin and Madeline will pursue modern dance careers in New York City.
The Accreditation Council for Graduate Medical Education recently instituted reduced work-hour guidelines. With this change, patient handoffs—or the process of transferring authority over a patient from outgoing caregiver to incoming caregiver—have increased by 40 percent. Although medical professionals understand that the handoff is critically important to patient safety, there is scant research characterizing the process. Therefore, Dr. Emily Patterson’s lab seeks to characterize patient handoffs.

My particular project compared resident physician, registered nurse, and nurse practitioner patient handoffs in intensive care units at the Wexner Medical Center. To study these handoffs, we ethnographically observed and audiotaped the handoffs. Then, we coded them for conversation topics (prognosis, diagnosis, status, family) and for conversation modes (clarifying, explaining, disagreeing, collaborative cross-checking). Collaborative cross-checking is the process by which care providers jointly solve problems and formulate a diagnostic and treatment plan for the patient. In this process, they ask “what if” and “why” questions of the outgoing clinician and play devil’s advocate to the previously assigned diagnosis. My most significant findings were that patient handoffs between resident physicians were shorter, more variable, and used more collaborative cross-checking than those between registered nurses, while nurse practitioners occupied a middle ground between the two disciplines, exhibiting best practice strategies. Allotting more time to the most challenging patients (those with uncertain diagnoses, for example) and less to those whose cases are resolved is an example of such a best practice strategy.

My lab has created ways to apply this research to real-life situations by developing an online training program for clinicians. The program educates care providers on more effective handoff techniques, such as how and when to initiate collaborative cross-checking.

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**Project title**: Patient Handoffs: Study of Residents, Nurse Practitioners, and Registered Nurses

**Advisor**: Emily Patterson

**Honors**: Third place, Denman Undergraduate Research Forum; Summer Research Fellowship at Nationwide Children’s Hospital

**What’s next?** Alexandra plans to attend medical school after graduating from Ohio State.
Rural people use mental health care services at far below the rate of those living in urban areas, despite a similar rate of mental illness between the two populations. Forty-two percent of Appalachia’s population is rural, and over one third of Ohio’s counties are considered part of the Appalachian region. My research examines narratives I collected from three mental health care professionals living and working in rural Appalachia, where I grew up, in order to better understand how narrative is a part of delivering social services and how the Appalachian identity interacts with and shapes the delivery of these services. In my analysis, I identified structural patterns and motifs that stand out in the narratives and discussed how these elements of storytelling work to provide insight into rural mental health care. I found that my narrators were apt to position themselves both as intervening on behalf of their clients and as positive forces in the lives of those they work with. They also demonstrate similar connections in identifying as Appalachians, a connection that brings meaning to their work and serves as motivation for continuing it in a specific geographic area. Overall, the narratives explore ongoing issues that exist in rural mental health care and how living with mental illness is changed by, complicated by, and shaped by the Appalachian identity.

Project title: Narrative and Mental Health Care in Appalachia

Advisor: Amy Shuman

What’s next? Sarah is spending 2013–14 teaching English in Bulgaria on a Fulbright fellowship. She then will teach in the Mississippi Delta as a member of Teach for America, before continuing her work with mental health care.
After I started running in Vibram Five-Fingers shoes, which mimic barefoot conditions, I had to know: do they really allow you to run faster, as devotees claim? My research advisor gave me Christopher McDougall’s *Born to Run*, about the renowned distance-running skills of Mexico’s Tarahumara tribe (who use the “toe strike” method required by barefoot running) and the project fell into place.

Our study’s goal was to examine physiological differences between racing in minimalist shoes (i.e., in “barefoot” conditions) and traditional running shoes (another researcher, Jessica Hyland, looked at psychological factors). A sample of 14 male, trained runners visited the lab to complete a two-mile race in either type of shoe, and then returned seven days later to repeat the race in the other type of shoe. The subjects were blinded to the time elapsed and their treadmill speeds. We analyzed their times to completion, speed, oxygen consumption, fuel utilized (respiratory exchange ratio, or RER), and heart rate. We found that peak oxygen consumption was significantly higher in barefoot runners, as was peak RER. Other variables did not differ between barefoot and shod. Thus, while performance in a two-mile race is not affected by whether the runner is barefoot or shod, barefoot runners worked at a higher intensity. This indicated that they were using not only a different pacing strategy, but a different fuel source (for example, carbohydrates rather than fats).

Our findings are important because they suggest the use of different pacing throughout the run, and the lack of a significant time difference between the two conditions calls into question the need for runners to purchase expensive shoes that tout a higher heel for cushioning and “guarantee” the ability to run faster. While shoes like the Five-Fingers protect feet while allowing barefoot conditions, people also do run barefoot.

**Project title:** Barefoot Running: Does It Improve Performance?

**Advisor:** Carmen Swain

**What’s next?** Sarah will be staying for her fifth year to complete her nutrition minor, and hopes to conduct further research with Dr. Swain. She also has an internship with Ohio State’s Strength and Conditioning program for Division I athletes.
Quantum Gold: The Quest for Super-Resolution Imaging

Seeing is one of the best ways to understand how something works. However, at some point, small objects that are close together are indistinguishable and appear as one blob under traditional optical microscopes. With this in mind, it is possible to design a system that uses bright/dark nanoparticles and computer algorithms to distinguish between the two small objects, providing high-resolution pictures. The development of such a system would allow biologists and other scientists to view structures (without damaging the organism) with microscopes at a higher resolution than was previously possible with traditional fluorescent imaging methods.

In my quest for such an imaging system, I used two types of nanoparticles. The first particle, a quantum dot, is very bright, while the second particle, a gold nanosphere, is capable of making the quantum dot become dark at short distances. At first, the two particles are held close together by a linker to make the quantum dot dark. But after the linker is broken by light energy, the particles move away and the quantum dot becomes bright. This dark/bright behavior will be used with computer algorithms to create higher-resolution images.

After overcoming instability issues, the gold nanosphere was able to make the quantum dot become dark in a control experiment. However, this behavior was not repeated with the actual linker. This suggests that the linker is too long; future work would use a shorter, reversible linker.

I enjoyed the interdisciplinary collaboration of Dr. Jessica Winter’s laboratory team. While she and a graduate student mentor, Qirui Fan, came up with the initial research design, the rest of the work has been my own. Since I began last summer, I am amazed at how much I have learned and the progress I have made on the project.

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**Project title:** Photocleavable Quantum Dot-Gold Nanoparticle Systems for Super-Resolution Imaging

**Advisor:** Jessica Winter

**Honors:** Award for outstanding research from the William G. Lowrie Department of Chemical and Biomolecular Engineering

**What’s next:** Nikita will continue nanoengineering research as a PhD student at Georgia Tech.
As a freshman, I took an African Studies course in which the professor discussed corruption as an inhibitor to the effectiveness of aid. This piqued my interest in the topic, and so when it came time to pursue an economics thesis, I decided to study the relationship between donor governments’ aid allocation decisions and the levels of corruption in recipient countries.

In recent years, donor states have emphasized good governance in international aid allocation decisions. This is a response to controversial findings in the aid effectiveness literature that assert that aid has a positive effect on growth in recipient countries. However, aid allocation studies have failed to find systematic punishment of corruption. Using improved econometric techniques, I was able to determine such a pattern. Controlling for recipient need and donor interest influences, I found that corruption matters in aid allocation decisions, but differs significantly across sectors and donors. As a whole, developed donor countries use lower levels of total aid to punish developing recipient countries with high levels of corruption. Donors prefer to give corrupt recipients more humanitarian assistance, and less production sector and social infrastructure aid. Further, corrupt recipients receive a higher percentage of their total aid as humanitarian assistance. These results support the theory that donors emphasize immediate relief in donations to more corrupt countries, forgoing investments in long-term growth and potentially perpetuating a vicious cycle of aid dependence.

One highlight of my research was presenting it alongside professors and doctoral candidates at the Midwest Economics Association annual meeting. Moving forward, my findings may bring policymakers’ attention to this issue, inspiring moves toward enhancing the long-term efficacy of international aid.

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**Project title:** Corruption and International Aid Allocation: A Complex Dance

**Advisors:** Nzinga Broussard and Trevon Logan

**Honors:** First place, Social and Behavioral Sciences, Denman Undergraduate Research Forum

**What’s next:** Lauren will work as a financial analyst for JPMorgan Chase & Co. while pursuing a dual MA in public administration and agricultural, environmental, and development economics at Ohio State.

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*“Exchange money conversion to foreign currency,” courtesy of epSos.de, Flickr (Creative Commons license CC BY 2.0)*

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International Aid Allocation

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My research investigated how notions of care and punishment among those who work with the homeless shape experiences of homelessness in Columbus, Ohio. I conducted a qualitative case study involving interviews and participant observation with the service providers, law enforcement officials, and others who define and respond to the crisis of homelessness in Columbus—a city known as an innovator in non-criminalizing strategies for addressing the challenges of homelessness. My goal was to answer the question: how are the politics of “anti-homelessness” and criminalization of homelessness characterized within what has been termed “America’s nicest city”?

The focus of my research was not whether Columbus’s response to homelessness has been punitive or supportive, or whether the city’s approach has reflected anti- or pro-homeless sentiment. Instead, I asked what these terms mean to decision makers. What are the conceptual and empirical limits of care and punishment, and who decides? What are the points of contention? How have different actors perceived their role in facilitating or providing care or punishment?

My results suggest that even as the city moves toward decriminalizing homelessness, the alternative compassion-based policies advanced by service providers and law enforcement continue to construct homeless individuals as criminal or pathologized “others” in need of discipline, surveillance, and containment. People often fail to consider the complexities of criminalization and the penal apparatus, and neglect to attend to the mechanisms through which criminality is produced. These failures create shortcomings in alternative approaches—specifically, collaborations between service providers and police officers—to handling homelessness.

**Policing the Homeless in Columbus**

**Maegan Miller ’13**

*Geography*

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**Project title:** America’s Nicest City? The Contentious Politics of Care and Punishment for the Homeless in Columbus, OH

**Advisor:** Mathew Coleman

**Honors:** Honorable Mention, Denman Undergraduate Research Forum

**What’s next?** Maegan will pursue an MA in geography at the University of California–Los Angeles.
Mutualisms (relationships that benefit both parties) between ants and plants are very common in the tropics. One of these revolves around plant structures called extra-floral nectaries (EFNs). These are nectar-producing glands found outside the flower, and are most common in the tropics. Ants climb up plants that exhibit EFNs and feed from them. In turn, these ants provide defense from intruding organisms, including herbivores. Over the summer, I traveled to Amazonian Ecuador to detail the incidence of EFNs on over 1,100 different species of neotropical trees. Once I discovered which trees had EFNs and which didn’t, I was able to use census data to determine whether trees with EFNs were more abundant, grew faster, or had lower mortality rates compared to those trees without EFNs. I then analyzed the same factors in EFN censuses completed in Panama and Malaysia. I found that trees with EFNs have consistently higher growth rates, but also higher mortality rates, which suggests that there may be a cost to this ecological strategy. That my findings were consistent across such diverse locations was very exciting.

This research furthers our understanding of tropical adaptive strategies that support the coexistence of an incredible number of different species within the same general area. By illuminating the mechanisms behind species diversification as a response to selective pressures, we can develop better strategies for conservation and for promoting species diversity in the face of human-caused extinctions.

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**Project title:** Incidence and Ecological Significance of Extra-Floral Nectaries on Tropical Rainforest Trees

**Advisor:** Simon Queenborough

**Honors:** Natural and Mathematical Sciences award for best project in organismal biology

**What’s next:** Andrew will work as an ecology field assistant in Wind River, Washington, and later plans to pursue a PhD in forest ecology.
As an Iranian American, I always felt like an outsider in my community. I was neither “Persian enough” nor “American enough.” This all changed when I visited Iran for the first time in 2010. The unique culture and beautiful artwork that has existed for thousands of years in Iran gave me the inspiration I needed to venture on a new journey to define my identity and artistic abilities. When I first started out as an artist, my work was broad and based mostly on university assignments. I was not aware of my potential, nor of my niche in the art world. However, after my trip, the colors and patterns of Iran’s mosques, mausoleums, and rugs inspired my new focus on patterns.

I became obsessed with intricate Middle Eastern designs that seem limitless on paper; the repetition of patterns invites the eye to enter the image at any point. As I make a light wash for the background, I create a meditative design at the center of the paper. From there, I develop a design that mesmerizes me, and that I discover further as I work on the piece. I continue until the page is covered with abstract lines. Of all the mediums I use, the one that most complements my work is gouache, a type of paint that is similar to watercolor, but heavier, more reflective, and opaque. I am then able to layer shapes in many colors and add fine details that create a bright but flat appearance. In my research with printmaking, I wanted to find a way to incorporate the patterns of my cultural background using screen printing, painting, and drawing, often in the same piece. I start with a screen print: first, I draw a pattern on acetate, then burn it into my screen. Once the screen is ready to go, I print the image on paper. I print the same image as a set and individualize each print by painting and drawing additional designs and altering colors. This is done to enhance the existing screen-printed image.

Project title: Pattern Obsession through Printmaking

Advisor: Charles Massey

Honors: Department of Art Faculty/Staff Award, 2013 Undergraduate Juried Exhibition

What’s next: Elaine will continue her exploration of printmaking through self-study while she pursues a career in textile design.
My research explores how the brain encodes and represents complex environments. By tracking the flow of blood through the brain, functional magnetic resonance imaging (fMRI) allows us to assess the neural processes underlying human perception. I use fMRI to measure brain activity as subjects view color photographs and line drawings depicting natural environments (for example, beaches, offices, and city streets). My goal is to identify what kinds of information the brain encodes from an environment and how this information supports various cognitive functions.

Despite previous research showing that structural information alone is sufficient to categorize an environment, I found that the brain relies on color and texture as well. I also found increased memory for color photographs versus line drawings, suggesting that color and texture are not only helpful, but essential for forming and retrieving memories of complex environments. By identifying which information the brain encodes and uses to support various cognitive functions, my research expands scientific understanding of the human visual system and informs artificial intelligence research into computer vision. In terms of clinical applications, certain scene-sensitive brain regions show abnormalities in schizophrenia; identifying how these regions function in healthy adults is essential to figuring out how abnormalities in these regions give rise to schizophrenic symptoms.

FMRI allows researchers to tackle difficult questions about human cognition that have challenged philosophers and psychologists since ancient times. I feel incredibly lucky on a daily basis to have the opportunity to use this powerful equipment as part of my research.

**Project title:** FMRI Repetition Suppression for Scenes in PPA Depends on Identical Feature Representation

**Advisors:** Dirk Bernhardt-Walther and Per Sederberg

**Honors:** Two Undergraduate Research Scholarships from the College of Arts and Sciences; Summer Research Fellowship from the Undergraduate Research Office and Department of Psychology; first place, 2012 Denman Undergraduate Research Forum; third place, 2013 Denman; represented Ohio State through the Brazil Research Exchange Program; honorable mention, National Science Foundation Graduate Research Fellowship Program

**What's next?** Thomas will begin a PhD in cognitive neuroscience and psychology at Yale University.
Dissolved organic matter (DOM) constitutes a major reservoir of carbon within the global carbon cycle. It is vital in natural remediation, specifically in the transportation of contaminants. The amount of dissolved organic matter in an aquatic system is directly related to dissolved oxygen, which has significant ecological implications. And finally, dissolved organic matter serves as a major pH buffer. Understanding the chemical composition and origins of a given sample, therefore, is important to environmental remediation strategies.

DOM is present in nearly any aquatic system, but the source varies. Organic chemists use the source of the DOM as a means of defining it. Its origins can be microbial (formed within the local aquatic system), terrestrial (formed elsewhere and transported to the watershed), or in between. Measurement standards for determining microbial or terrestrial origins exist, but there are none for intermediary DOM. Furthermore, different extraction methods capture different aspects of DOM, which makes comparison between samples obtained by different means impractical.

For my project, I attempted to address these shortcomings by testing a novel extraction method and isolating an intermediate composition standard from Old Woman Creek in Huron, Ohio. My driving questions were, are there discrete differences associated with different extraction methods? And does Old Woman Creek represent an intermediate source of DOM, thus allowing us to establish a new measurement standard for intermediary-composition DOM?

It was exciting to determine that indeed Old Woman Creek would be a viable source of the intermediate standard, though the process for having the standard accepted for widespread use would be long. I loved capturing a result—a microbial peak—that my advisor had never seen before. I also enjoyed the combination of lab work, field work, and presentations during the research process.

**Project title:** Dissolved Organic Matter Contains Previously Unidentified Protein-Like Fluorophores in Old Woman Creek

**Advisor:** Yu-Ping Chin

**What’s next?** Victor is now working with Red River Paleontology in Texas.
Snow cover in the Midwest is a key contributor to the hydrologic cycle of the Great Lakes and, in light of the warming climate, could face serious changes in the near future. Snow cover strongly correlates to winter air temperatures, and my research examined how snow patterns around the Great Lakes will change with a global air temperature increase of one degree Celsius. To do so, I compiled historical climate data in order to better understand average winter air temperatures as well as average snow cover duration throughout the Midwest region. I used this climate data to create maps that show how these two variables will change as average winter air temperatures increase one degree Celsius. My results show that a large area in the Great Lakes basins will experience a shift from its current long winter snow cover to a more sporadic winter snow pattern, much like what we experience in Columbus. This shift in seasonal snow pattern is important to understand because it can have major biogeochemical, ecological, and societal impacts in our near future.
I have long been interested in different dialects, particularly those in Ohio. This project evolved as a follow-up to my advisor’s dialect research. My driving questions were, do people think there are different dialects in Ohio, and can they place them on a map? What features do they associate with these dialects, and can they reproduce them in mimicry?

At the Buckeye Language Network’s lab, I asked participants to first color in a map of Ohio, using a different color for each area where they think people speak differently, and second, to read a list of sentences while mimicking a dialect they had colored on their maps. I looked for patterns in the way people colored their maps and found that people’s beliefs mostly align with linguists’ assessments of dialects in Ohio: the Inland North dialect occurs in the Northeast, the Midland in the center, and the Southern accent in the southeastern and Appalachian areas of the state. I used acoustic analysis to determine that while people are able to recognize different dialects, it’s harder for them to replicate them. Most participants also mentioned that while mimicking the dialect, they were thinking of someone they knew with that dialect, which illustrates that dialects spread through interactions with people.

The maps show not only what accents people think exist in Ohio but also if they perceive central Ohio as non-accented, or if their perceptions are changing to see central Ohio as having its own accent. The mimicry results help explain how different accents are perceived and which aspects of the language (for example, speech rate and vowel positions) people use to identify accents. It’s important to understand how people perceive dialects because the way people speak is intertwined with their identities.
As part of Ohio State’s Shakespeare and Autism Project, a team of actors, including me, used Shakespeare’s *The Tempest* to help children with autism improve social and cognitive skills. The project is a collaboration between Ohio State’s Department of Theatre, the Nisonger Center for the study of developmental disabilities, and Kelly Hunter of Great Britain’s Royal Shakespeare Company. The goal is to gather evidence that Kelly’s Hunter Heartbeat Method improves social and emotional skills in those with autism. Over a period of several weeks, the other actors and I met with elementary and middle school students once a week to use Shakespeare’s lines to practice different modes of emotional expression. Kelly’s approach hinges on the facts that Shakespeare’s work is intensely emotional and, like the human heartbeat, follows iambic pentameter.

Caliban the monster, Prospero the magician, Ariel the fairy, and others have helped us break through many stereotypes associated with autism. Our research is ongoing, but we actors have already observed the benefits. Through the use of the Hunter Heartbeat Method and playing these games each week, the children are showing that they are capable of retaining bits of information, like lines that one character says to another, while making bold and often hilarious physical gestures. They demonstrate each week that they are understanding and recognizing the differences in the many facial expressions—from happy to fearful—that we use with the “hello” we repeat at the start of each session. They are using the same techniques actors use (to make character choices) to help themselves express their emotions externally and fight the barriers of autism.

**Project title:** Shakespeare and Autism

**Advisor:** Joy Reilly

**Honors:** Undergraduate Research Scholarship from the College of Arts and Sciences; grant for travel to London from the Aida Cannarsa Snow Endowment Fund; award from Department of Theatre for Shakespeare and autism work; additionally, the Shakespeare and Autism Project has received press coverage in *The Washington Post, Columbus Dispatch*, and other outlets.

**What’s next?** Andrew traveled to London in summer 2013 to study theatre and the Hunter Heartbeat Method. After graduation, he plans to continue using theatre to effect social change.
You never know when an earworm will strike. Suddenly that song you heard on the radio yesterday won’t leave your head, no matter how hard you try to evict it, and it might take hours or even days for the torture to end. I was studying one night and couldn’t get Carly Rae Jepsen’s “Call Me Maybe” out of my head. I joked to my friends that my thesis should look into why that song is so catchy. Very little is known about the neural mechanisms of earworms, despite the fact that they are a common phenomenon, and it hit me that studying them would be a great way to combine my two majors, neuroscience and music.

For my honors thesis, I investigated whether people could voluntarily stop earworms. Participants listened to clips of Psy’s “Gangnam Style,” “Call Me Maybe,” and other catchy tunes and then underwent suppression training sessions, followed by a recognition memory test. An EEG version of the experiment measured neural correlates of earworm suppression.

Earworm suppression strategies are useful beyond merely ending annoyance. They could be applied to other types of involuntary thoughts, such as those seen in obsessive-compulsive disorder. Pervasive, recurring memories are also characteristics of post-traumatic stress disorder and other anxiety disorders. Because music is a complex stimulus that more closely models these recurring memories, strategies for earworm suppression may represent a novel thought-suppression strategy for patients with these conditions. Greater insight into earworm suppression also could lead to better understanding of the musical hallucinations and obsessions observed in biological psychiatry.

**Project title:** Developing an Earworm Suppression Strategy Using the Think/No Think Paradigm

**Advisor:** Per Sederberg

**Honors:** Undergraduate Research Scholarship from the College of Arts and Sciences

**What’s next?** After graduation, Christine will take a year off before applying to graduate school in counseling psychology.
Offensive and defensive football linemen have a high incidence of knee cartilage injuries and are at high risk for developing osteoarthritis at a young age. The purpose of this study, which was funded by NFL Charities, was to characterize the biomechanics of linemen-specific movements as a first step towards understanding cartilage injury risks in this population. The other lab members and I looked at the way the athletes performed the movements by looking at the angles and forces that their knees were subjected to. Each athlete performed a variety of tasks, ranging from walking trials to linemen-specific blocking movements. Reflective markers were taped to their bodies and special video cameras were used to record their movements. Force plates in the floor recorded the forces between the athletes’ feet and the ground. We then calculated angles and forces about the athletes’ knees to help determine the degree of risk brought on by those movements. The data collected during this study will help determine why this population is at a higher risk for knee cartilage injuries and hopefully help find a way to prevent these types of injuries. Our results also may be helpful to researchers looking into cartilage injuries in other sports.

My freshman year, Dr. Robert Siston spoke to my research survey class, and I knew I wanted to work on this project when I was ready to begin my own research. My role was to assist with processing and testing data; I then took pieces of the data and formulated my own results for my Denman project.

**Project title:** Biomechanical Analysis of Functional Movements for NCAA Football Linemen

**Advisor:** Robert Siston

**Honors:** 2012 Undergraduate Research Office Summer Fellowship

**What’s next?** Jay will continue research with Dr. James Onate of Health and Rehabilitation Sciences in the College of Medicine.
The 2014 Denman Undergraduate Research Forum will be held on Wednesday, March 26, 2014.

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