**URGO Summer Research 2015**

# Student Abstracts

Below are the abstracts for all the student research projects performed on campus through URGO grants for summer 2015.

## Alex Sushko (‘17, Physics)

Dr. Ben Stottrup

The intricate study of nanoparticles and lipid monolayers has fascinated many biophysicists in recent years, and continues to be a highlight of study in biophysics and materials science. This summer, my coworker and I are working to better understand the features of the Kibron Langmuir Trough, as well as to design a system where we can closely monitor and control the water level in the trough after depositing materials onto the surface. We will be testing the new software that came with the Kibron Langmuir trough and will observe how well the trough can produce consistent and reliable results in a set of several small experiments. In addition, we will use a PID controller system (through LabView) to designate directions to miniature pumps that will monitor the water level at the trough’s surface. After all the setup is complete, we will most likely test our system to see if our data from the experiments proves to be more accurate and contains a better set of reliable data.



## Ali Plieseis (‘17, Chemistry)

Dr. Michael Wentzel

Amides are an essential part of the human body as they are the key chemical connections of proteins. They are also widely used in synthetic applications and are present in a substantial amount of pharmaceutical drugs. The current method for amide formation is incredibly general, but comes with challenges of temperature control, lack of scalability, and waste generation. To avoid these obstacles, a heterogeneous catalyzed continuous flow reactor was used for amide synthesis in an efficient and cost effective manner. Derivatives of phenylacetonitrile and various amines were used in an equivalence of 1 to 8 in order to synthesize the highest yield of product. This appealing process for the formation of amide bonds may be useful for the development of new pharmaceutical drugs.



## Amanda DeChaney (‘15, Biology)

Dr. Nidanie Henderson-Stull

Src family kinases are enzymes that function to add phosphate groups to specific amino acids on itself and other proteins. Src is present in all human cells and has important roles in cell division and migration. As such, increases in Src activity can lead to metastasis of breast, colon and prostate cancers. Our labaims to determine the three-dimensional shape of the enzyme when it is active and as it transitions to its inactive state so that we can understand its role in metastasis better. This summer my goal was to prepare and extract the inactive version of the Src enzyme in the fission yeast *Schizosaccharomyces pombe*. Specifically, I expressed Src with another enzyme Csk that phosphorylates the amino acid tyrosine in position 527 on Src. After preparing the enzymes, I used anti-Src, anti-phosphotyrosine, anti-pY16 and anti-pY527 antibodies to detect that Src was expressed and that key phosphorylation states needed for Src inactivation were appropriately absent or present in the inactive form of the Src enzyme I prepared.



## Andrew Jewell (‘18, Computer Science)

Dr. David Crowe

It has long been agreed that leaky integrate and fire (LIF) spiking neural network models require the long time course of NMDAR-mediated currents to maintain their stability (Wang 99, Wang and Brunel 2001). In addition, recent animal studies have shown that the acute injection of a NMDA receptor antagonist such as phencyclidine causes a decrease in the number of action potential coincidences in the prefrontal cortex. We investigated the role that NMDARs have on such coincidences by assembling a fully-interconnected LIF model consisting of 2000 excitatory neurons and 500 inhibitory neurons. We found evidence of zero-lag spike timing coincidences within the active excitatory cells and a reduction of zero-lag coincidences within the inhibitory neurons. We also tested the effects of NMDAR blockade in the model for comparison to the animal data.

## Andrew Konieczny (‘17, Biology)

Dr. Matthew Beckman

In this study the effects on *Daphnia magna* swimming force production of serotonin receptor (5-HTR) agonists and antagonists were tested. *Daphnia magna* are keystone species in many freshwater ecosystems worldwide. Freshwater reservoirs are often contaminated by drugs and chemicals, some of which interact with the serotonin neurotransmitter system. To better understand how these contaminants affect animal behavior we wanted to know if *Daphnia magna* swimming was modulated by 5-HT receptor activation or inhibition. A force transducing instrument that employed a calibrated fiber to record the force exerted was used to collect data. Two synchronized cameras were used to record, 1) animal swimming and 2) fiber displacement from different perspectives, simultaneously. Custom software was employed to analyze data and perform statistical tests. Preliminary data suggests a change in swimming force and swimming episodes when treated with differing concentrations of Xaliproden, a 5-HT1A agonist. Further experiments are required to determine the role that the 5-HT1A receptor signaling pathway plays in *Daphnia magna*. This study provides the first data we are aware of that documents the role of 5-HT1A signaling in *Daphnia magna* swimming and suggests this is a useful model organism to study the role of 5-HT in motor control.



## Blair Stewig (‘18, Biology & Chemistry)

Dr. Ben Stottrup & Dr. Joan Kunz

Hydroxycholesterols play a large role in the management of cholesterol levels in mammalian cell membranes. Isomeric hydroxycholesterols are oxidized versions of cholesterol molecules that vary by the orientation of the second hydroxyl group on the molecule. This variation in orientation could possibly cause variance in the hydroxycholesterols behavior. Hydroxycholesterols, 22(r)-OH and 22(s)-OH, are being explored to examine how a difference such as stereochemistry can change the behavior of the molecules when in a lipid (DMPC) monolayer. Using a Langmuir NIMA Trough, fluorescence microscopy, and HC imaging the molecules behavior in a monolayer can be observed. Isotherms were used to show this behavior, plotting pressure vs. molecular area. Taking images of hydroxycholesterol-rich domains and phospholipid-rich domains, provided a physical images of the phase-behavior of the molecules examined. Through these processes, the behavior between 22(r) hydroxycholesterol and 22(s) hydroxycholesterol has proved to be particularly interesting. Although chemically the same and physically similar, their differences seem to lie in their phase behavior. Exploring these molecules has provided helpful insight on the behavior of two very similar yet different hydroxycholesterols, thus providing information that can be used by others in the field of biophysics in the future.



## Caitlin Crowley (History)

Dr. Phil Adamo

This paper studies the relationship between Robert Belton, an African-American gospel singer, poet, and speaker, and discussions of racism and discrimination on Augsburg's campus. Belton's talks to Augsburg students in the late-1930s led Augsburg students to engage for the first time in discussions about racism, while simultaneously revealing a prevailing ignorance amongst the entirely white student population. Discussions of racism and discrimination like the ones that Robert Belton, or "Uncle Bob," began are still all too relevant to Augsburg students today.



## Chau Nguyen (’17, Business Management and Marketing)

Dr. Bernard Walley

This paper studies the effects of monetary policy shocks on domestic economic activity in emerging countries, with a special focus on Brazil from 1996 Q1 –2014 Q4. Using the structural vector auto regression (VAR) method, we investigated the dynamic behavior of aggregate economic activity in response to shocks to US interest rate, country interest rate, and depreciation rate. We also use variance decomposition to study how much of the innovations in domestic economic variables is explained by the monetary policy shocks. The key findings of this paper are as follows: (1) In response to a positive shock in US interest rate, inflation rate rises sharply first then experiences a steady decrease, and this behavior is similar to how inflation rate reacts to a positive shock in country interest rate; (2) As country interest rate increases, the output decreases; (3) As country interest rate increases, trade balance decreases slightly in the period of impact, and then gradually increases; (4) Country interest rate shocks explain about 50 percent of the change in output; (5) US interest rate shocks explain about only 1 percent of movements in aggregate activities; (6) Country spreads explain about 14 percent of trade balance.



## Claire Cripps (‘16, Exercise Science)

Dr. Anthony Clapp

Maximal oxygen consumption (Vo2max) is the most accurate measure of cardiovascular function. Vo2max testing entails exercising incrementally until exhaustion and oxygen consumption apexes. Flaws of maximal testing include high physical demand, expensive equipment, time consuming, and risk of injury. Submaximal assessments are a valuable alternative in providing a cost effective and less strenuous method to determine Vo2max. The purpose of the study was to devise a submaximal skate test generating a regression formula that accurately predicts Vo2max. 42 subjects representing the general public, 21 males and 21 females between the ages of 20 and 60 self-classified as competent skaters participated (age=31.9 ± 6.6 yrs, ht.=68.2± 4.6 in, wt.=168.3 ± 23.3 lbs). All subjects completed a maximal graded exercise test with expired O2/CO2 gas analysis then completed the submaximal skate test. Through the regression analysis, skate time was the only factor that indicated a moderately weak correlation; all other factors had no significant correlation in our regression analysis. The regression formula generated: Vo2max = 54.27 – (2.57 x skate time) where p = .0149, R-squared = .13, and SEE = 5.604 ml/kg/min. This study revealed that this on-ice single stage, steady state, skating assessment produced a standard for estimating VO2max.



## Davy DeKrey (’17, Biology)

Dr. Ann Impulitti

The fungal pathogen *Phialophora gregata* causes the disease brown stem rot (BSR) of soybeans (*Glycine max*) and is known to decreases crop yield. BSR can be difficult to diagnose due to the lack of symptoms of disease during the long latent phase of the disease*.* Previous studies have shown that stress caused by diseases can modify the light reactions and carbon fixation cycle during photosynthesis. Therefore, we investigated the physiology of soybeans at different stages in order to determine if the impact of BSR could be detected during asymptomatic infection. Resistant and susceptible varieties of *G. max* where inoculated with type A, which causes foliar symptoms, and type B, which does not cause foliar symptoms of *P. gregata*. The light reactions were assessed by measuring chlorophyll fluorescence and non-photochemical quenching and the carbon fixation reactions were measured by CO2 assimilation every two weeks post-inoculation. The presence of the pathogen was confirmed by using a polymerase chain reaction (PCR) with primers specific to type A and B of *P. gregata*. In the future quantity of the pathogen in the plants will be determined using real-time quantitative polymerase chain reaction (qPCR). Results will further the understanding of the relationship between *G. max* and both forms of *P. gregata.*



## Derek Ruff (‘16, History)

Dr. Phil Adamo

Abstract forthcoming.



## Devin Wiggs (’16, Sociology)

Dr. James Vela-McConnell

The literature on stigma has been almost exclusively concerned with individual analysis since its original theoretical conception. Consequentially, the applicability of stigma for other levels of analysis, such as organizations, has been both underrepresented and largely undefined. This paper examines the stigmatization of the Catholic Church from the sex scandal that surfaced and persisted through the early millennia. More specifically, this study uses the Catholic Church as an example to examine the process in which an organization becomes stigmatized. Beginning in 2002, media sources framed the Catholic Church as having a “culture of secrecy” and a clerical structure that enabled child abuse — one where “Irresponsible Bishops” covered up the abuse of “Pedophile Priests.” The hierarchal structure of the church was stigmatized as a result. As the scandal progressed, abuse allegations persisted and leaders throughout the church were discovered covering up the abuse. These discoveries further discredited the hierarchal structure of the church. Accordingly, the stigma categories of “discreditable” and “discredited” are not static categories for organizations; rather, an organization can move from one category to another if its structure is perceived to produce undesirable actions. In addition, organizations can move within a “discredited” status if leaders cannot fix its structure.



## Elise Linna (‘17, Biology) & Jubilee Prosser (’18, Biology)

Dr. Emily Schilling

Our research addresses knowledge gaps on the habitat preferences, geographic distribution, and colonization history of *Rhionaeschna mutata* (Spatterdock darner dragonflies) in Minnesota. This species is rare within its range and is listed as a species of concern in most states where it is known to occur. Anecdotal evidence suggests that it does not co-exist well with fish and has other habitat requirements that limit its distribution. We used a multipronged approach to provide preliminary information that may be useful in conservation planning for this species, including: 1) identifying potential breeding ponds based on site characteristics, 2) surveying a subset of potential breeding ponds to catalog invertebrate communities, water quality, and habitat characteristics, 3) searching for adult dragonflies and their exuvia , 4) extracting and rearing eggs oviposited into lily pad stems, and 5) analyzing pond sediments to determine if paleolimnological techniques could be useful for determining colonization history. No adult or larval R. mutata were found during our six-week field season. Additionally, no dragonfly remains were discovered in our sediment samples, suggesting that paleolimnological analysis of their colonization history is not feasible. These results are preliminary and lays the groundwork for further study of potential breeding sites.



## Weixin Peng (’17, Math & Finance)

Dr. Stella Hofrenning

President Obama in his state of the union address unveiled a proposal to offer two years of free community college tuition for eligible students. One of the goals of the program is to break down the financial barriers that keep many students from pursuing a degree and make a bachelor’s degree more affordable. The President’s proposal is based on the Tennessee HOPE program which provides both merit and needs based scholarships for students to attend college. However, there is some research that finds reducing the cost of community college does not impact persistence, graduation rates, academic performance or expected earnings. This research examines the HOPE program as well as similar programs in other states. In addition, this research calculates wage differentials among persons with high school diplomas, some college and bachelor degrees. Do students receive higher wages with additional college classes compared to receiving a high school diploma? States with low returns on some college and associates degree attainment (North Dakota, West Virginia, Nevada, Utah, and Montana) are more likely to lose those residents to other states with more vibrant economies that reward college graduates with relatively higher pay. States with large manufacturing sectors reward workers with high school diplomas with high wages while their counterparts with college degrees make low wages relative to other states. Given the decline of employment in the manufacturing sector in all states across the U.S., there are important policy implications regarding the strength of a states’ tax base and economic development.



## Gregory Lewis (History)

Dr. Phil Adamo

Oscar Anderson was president of Augsburg College at a pivotal moment in the history of the college and the nation. The 1960s and 1970 saw Civil Rights movement, and the Vietnam War, playing out on campuses across the country, including at Augsburg. It was also a time of growth for the physical plant such as the music Building, Christensen Center, and the residence towers. Anderson lead us from being a college “in the city” to one “of the city” by expanding our connections into the city and becoming part of the ACTC schools: St. Catherine, St. Thomas, Macalister, Augsburg, and Hamline. During Anderson’s tenure, the college’s curriculum expanded  as well, Developing new departments such as the Music and Theater department, and also seeing the creation of many of the social sciences.



## Jeff Cornell (Sociology)

Dr. Nancy Fischer

The purpose of this study is to uncover the current facilitators and barriers of engaging women in cycling as transportation. The study focused specifically on women cycling in an urban setting. Five transportation advocates, as well as seven women who bicycle, were interviewed to uncover these facilitators and barriers. In addition, field research was conducted at several bicycle paths in Minneapolis. Helmet use and type of bicycle were recorded for both women and men in order to uncover trends in equipment, safety perceptions, and infrastructure preferences. The interviews identified several key barriers preventing women from bicycling as transportation: Gendered roles as caretakers of children and homemakers, a male dominated cycling culture, cultural expectations on women’s appearance, gender-based harassment and violence, and current bicycle infrastructure. In addition, several major facilitators were discovered: Social events, community events, educational opportunities, and in certain contexts, infrastructure. Field research discovered that bicycle paths with a physical separation from motor traffic yield the highest ridership for women cyclists. The challenges and successes of integrating bicycling into women’s daily habits was the overarching theme that was taken away from the study. It was unclear whether cultural factors or the built environment more greatly affected women’s decisions to bicycle. However, both cultural factors and the built environment were seen to be in need of changes in order to engage more women in bicycling.



## Joe Kempf (‘16, Chemistry)

Dr. Michael Wentzel

Even though polymers compose a large portion of our modern society, the principles of polymer chemistry are rarely communicated in an undergraduate education. For the most part, polymer synthesis is prohibitively costly; requiring complex procedures, toxic solvents, and specialized facilities. This bench-ready procedure is designed to introduce students to principles of polymer chemistry while also demonstrating concepts of green chemistry. Previous bench-ready polymer procedures have resulted in a poly-lactide with good bending and stress resistant characteristics. However, the use of HCl gas as a catalyst remained cumbersome and presented risks to students and the environment. To this end, safer catalysts are being investigated for polymer synthesis. The use of Diphenyl Phosphate (DPP) is considered as a possible catalyst to replace HCl gas. The effectiveness of DPP was confirmed using 1H-NMR analysis. The physical characteristics of the poly-lactide were found to be tunable by varying the amount of monomers as well as the specific initiator compound used.



## Jossel Franco (’18, Music Therapy)

Dr. Roberta Kagin

The William W. Sears Collection, donated to Augsburg College in 2012, is the personal library of the pioneer music therapist after which the collection is named, Dr. William W. Sears. Active in the early days of the music therapy profession, Dr. Sears is most known for creating the foundation of music therapy theory. The Sears Collection, containing almost 2,000 books, journals, and papers, reflects the kinds of ideas that influenced the development of Dr. Sears’s theories and his understanding of music therapy. This study seeks to understand how broadly William Sears thought about music therapy by classifying the contents of the Collection to identify the main subjects that interested him. The Library of Congress Classification system served as a model for organizing the contents of the collection. Additionally, Margaret Sears, Dr. Sears’s wife and donor of the collection to Augsburg, was interviewed in order to better understand Dr. Sears’s personal philosophy towards music therapy. The contents of the collection were ultimately classified into one of 16 distinct groups such as music, psychology, mathematics, and social sciences. The wide variety of subjects in the Sears Collection reveals Sears’s multidisciplinary approach towards music therapy, reflective of his philosophy that music therapy relates to all human experiences.



## Kaitlyn Terrio (’17, Biology & Chemistry)

Dr. Jennifer Bankers-Fulbright

In lung secretions there are many proteins that serve as anti-microbials that can fight off bacterial infections, including those caused by *P. aeruginosa*. Most humans easily clear this bacteria if it is inhaled, but people with cystic fibrosis do not and this particular bacteria is the dominant cause of death for these patients. Previous research done in the Airway Inflammation Research (AIR) lab indicates that there may a protein within normal lung secretions that can inhibit *P. aeruginosa* which is absent in CF lung secretions. The goal of this research is to identify the protein(s) responsible for this inhibition and determine the defect in CF secretions.



## Kaylie Johnson (’17, Music Therapy & Clinical Psychology)

Dr. Annie Heiderscheit

Mental health settings are common workplaces for music therapists. Numerous studies have been conducted that examine interventions and effectiveness of music therapy in various mental health settings. Despite this, to date, there is little research that discusses how music therapy is implemented specifically in adolescent inpatient mental health units. The purpose of this study was to poll music therapists about their clinical practice in order to (1) examine goals assessed in music therapy sessions and (2) examine interventions utilized in adolescent inpatient mental health units, in order to inform other music therapists and clinicians about how music therapy is implemented in this population. Participants were board-certified music therapists who were listed by the Certification Board for Music Therapists as working or having worked with adolescents in psychiatric inpatient settings (*N*= 64).  The survey contained 35 questions with information about demographics, session setting, goals addressed, interventions utilized, and perceptions of the effectiveness of music therapy. The most commonly addressed goals were to improve self-expression, improve self-esteem, increase positive socialization, and increase knowledge of coping skills, with 92.86% of participants reporting that they address these goals. The most commonly utilized intervention was song discussion (92.86%), followed by lyric analysis (83.93%) and songwriting/ song composition (82.14%). In their clinical practice, music therapists utilize many different interventions to address a wide range of goals. Goals and interventions are influenced by client diagnoses, group setting, strength of rapport with the clients, and theoretical orientation. Implications for future research are discussed.



## Kristine Volz (‘16, Chemistry)

Dr. Michael Wentzel

C-H bonds are prevalent in organic molecules, and a method to regioselectively and chemoselectively react such bonds would be of great use in synthetic chemistry. Substrates containing a variety of directing groups and alkynes were synthesized.  Inter-molecular and intra-molecular ring cyclization through *ortho* C-H activation by metal catalysis was investigated. Reaction conditions for use with green iron-catalysts were also screened.



## Maifa Belghoul (‘15, Biology)

Dr. Nidanie Henderson-Stull

Fifty percent of colon, lung, liver, breast, and pancreas tumors possess activated Src protein (1). The activity of Src is regulated by the addition of phosphate groups on tyrosine amino acids at two different locations on the protein. When Tyr-416 is attached to a phosphate group, Src activity is turned on, and when Tyr-527 is attached to a phosphate group, Src activity is turned off. Numerous laboratories have attempted to determine the three-dimensional structure of Src in its different activation states in order to improve our understanding of its role in cancer. Here we report the expression of Src of what we predict to be its transition state when no phosphate group is attached to the protein. We used gel electrophoresis and Western Blot to confirm the phosphorylation state of our protein. Our results are the first step towards future structural studies of the unphosphorylated, intact Src protein.



## Marimar Bustos (‘16, ESL Education)

Dr. Audrey Lenismire

The purpose of this project was to more closely examine the historical, sociological, and anthropological aspects of El Salvador, with a focus on the civil war that occurred between 1979 and 1992. What can be ascertained through this research is that El Salvador is a country that has gone through tremendous strife and suffering, from Spanish colonization to present day. Nevertheless, it is a beautiful country that has a lot to offer culturally, and a lot to learn from historically. The information collected will then be incorporated into a culturally relevant work of literature targeted towards high school students. Cultural relevancy is a concept established by educational theorist Dr. Gloria Ladson-Billings that seeks to validate and affirm the identity of students of all cultural backgrounds. Salvadoran-Americans currently make up the third largest Latino ethnic group in the United States, but there is very little representation of this ethnic group in the media and in literature. In this proposed work of fiction, Salvadoran-American students will be able to identify with and feel empowered by learning about their history, a history that is not taught in American classrooms.



## Markus Singh (’16, Biology)

Dr. Ann Impullitti

Soybeans (*Glycine max* L. Merr) grown in the United States are used to manufacture many different soy-based products around the world. However, many soybeans are damaged by *Rhizoctonia solani* and *Fusarium virguliforme*, which cause Rhizoctonia Root Rot and Sudden Death Syndrome, respectively. One potential way of addressing the problem of diseased soybeans is to use endophytes as a means of biological control. Therefore, we investigated the use of endophytic fungal metabolites to reduce pathogenic growth of *R. solani* and *F. virguliforme* in soybeans. We grew 23 native Minnesota fungal endophytes in potato dextrose broth (PBD). After 7 days, the fungal mass was removed by vacuum filtration, and the remaining fungal broth was used to make concentrations of 10% and 20% (v/v) metabolite plates in order to determine if growth of *R. solani* and *F. virguliforme* was reduced. The results suggest that 20% of the fungal metabolites from MN endophytes reduced growth of both pathogens. If effective when directly applied to plants, then soybean growers could then use these fungal metabolites as an alternative to chemical pesticides.



## Michael Alves (‘17, Chemistry)

Dr. Dave Hanson

An Ambient Pressure Mass Spectrometer (AmP-MS), coupled with a corona discharge ion source, was used to analyze direct breath samples for volatile organic compounds (VOCs). The AmP-MS uses H3O+ reagent ions to detect compounds with a high proton affinity, around 820 kJ/mol and more, down to a parts per trillion level of detection. Due to the nature of this method, amines and some ethers are efficiently detected compared to other types of molecules. Though this technique cannot detect many VOCs, its sensitivity and selectivity to amines and ethers makes it a great candidate for breath analysis. Such breath molecules found in this research include: 2-methyl furan, pyridine, and aniline. All of which have been reported in past studies [1]. Because of the complexity of human breath and the fact that AmP-MS has not been characterized for analysis of breath samples, standardized methods were explored here. The development of the method includes the parameters of how breath flow is sampled and the process of obtaining data and background information.



## Michael Kantor (‘16, Exercise Science)

Dr. Ana Ribeiro

Recent research indicates that over one third of American adults are obese (Ogden, Carroll, Kit, and Flegal, 2014) and only 48% of adults meet the recommended physical activity (PA) guidelines (U.S. Department of Health and Human Services, 2008). In this context, understanding what makes people engage or not in PA becomes of key importance when attempting to prevent obesity and its related comorbidities. Objective: To assess the PA and motivation levels of students, faculty, and staff in an urban Midwest Private College. Methods: Participants completed an anonymous online survey (n=119) on PA and Exercise Motivation. Fitness levels were tested and obtained from wellness assessments (n=74). Multiple regression statistical models were used to test age, body composition, and gender effects on motivation, PA engagement and fitness factors. Results: Less than half of participants met the 2008 PA Guidelines. BMI was a significant predictor of overall fitness. Males were more motivated by competition and age was a significant predictor on 5 subscales of motivation. Males had greater muscle strength and endurance, while females were more flexible. Conclusion: PA and obesity prevalence matched national averages. Results suggest that age and gender are significant predictors of fitness and motivation to exercise.



## Miles Turk (‘17, Chemistry)

Dr. Michael Wentzel

Aniline derivatives were used to synthesis Amides using a TiO2 catalyzed continuous flow reactor. This is a continuation of research where temperature, flow rate, stoichiometry were varied to produce optimal reaction conditions. Those conditions being 200oC, a 0.25 ml/min flow rate, and a 1:8:1:4 (aniline:nitrle:H2O:THF) molar ratio. In efforts to obtain higher yields of amides collection time and size of column in the reactor were varied. By varying these conditions, optimal collection time was found collecting product for 1hr and 54min. A 5 micron fritted column consistently gave higher yields where as the 2 micron fritted column was less consistent in obtaining high yields and more prone to clogging.



## Nick Talmo (‘16, Biology)

Dr. Ann Impullitti

Fungal pathogens of soybeans cause an estimated 3.58 million acres in crop loss each year in the United States. Fungicides are applied to seeds prior to planting to inhibit the growth of these fungal pathogens, however the impact of fungicides on the non-pathogenic fungal community within soybeans is unknown. Soybean stems from two varieties of soybeans that were treated with fungicides or non-treated were collected at the V1 and V4 growth stages, surface sterilized and used for culture dependent (CD) and culture independent (CI) analysis. For the CD analysis, cross sections from above and below the soil line plated onto acidified MEA to produce fungal cultures for DNA extraction and identification. For CI analysis, DNA was extracted from tissue samples, DNA amplified using fungal specific primers (ITS1F and ITS4), and then sequenced. Vast fungal diversity can be seen across all treatments and controls. Fungal morphotypes were separated by color, hyphal growth pattern and rate of growth and preliminary results from CD analysis indicate that at least 15 morphotypes were identified. Currently we are amplifying the fungal DNA from the soybean tissue using the fungal specific primers ITS1F and ITS4 in order to sequence and identify fungal species. Once fungi are identified and impacts are assessed, knowledge of this diverse community can be used to study endophyte interactions, further increasing crop yields and sustainable agriculture.



## Nyssa Capman (‘18, Physics)

Dr. Ben Stottrup

The behavior of 27-OH cholesterol during phase change is currently unknown. 27-OH and other oxysterols are important in apoptosis, which is self-destruction of the cell. I’m going to be studying the behavior of 27-OH during phase change by making samples with different concentration of 27-OH and collecting data from the pressure isotherms by using a Langmuir trough.



## Oksana Burt (‘17, Biology)

Dr. Matthew Beckman

*Daphnia magna* are freshwater microcrustaceans that have been used in toxicology research for decades. One common test involves exposing *Daphnia* to a drug or chemical and assessing its movement. Daphnids possess a rich motor program, yet, not much is known about the neurochemical control of movement. We sought to use *D. magna* as a model organism to determine the role of serotonin in movement, an understudied area of research. *Daphnia* were treated with agonist and antagonist drugs targeting 5-HT 1A and 5-HT 7 receptors. Animals were filmed for one minute from above to make 2D movies at various time-points following treatment with 10 μM drug solutions. CTRAX, an open-source software, was used to track *Daphnia* swimming. Statistical analysis showed the effects of two of these drugs on 5-HT 1A receptors were significant. Xaliproden hydrochloride, a 5-HT 1A receptor agonist showed inhibition by decreasing the total swimming distance; whereas, NAD 299 which is a 5-HT 1A antagonist, increased total swimming distance. These findings indicate that a serotonergic signaling pathway is involved in the neural control of *Daphnia* movement. Additionally, this research supports that *Daphnia* *magna* are valuable model organisms in studying the role of serotonergic signaling in animal movement.



## Rebecca Hillebrand

Dr. Lars Christiansen

Abstract forthcoming.



## Ryan Nichols (‘16, English)

Dr. John Schmit

A look at how graphic novels use multimodal strategies to provide a variety of complex avenues for meaning making. Alan Moore and Dave Gibbons’s *Watchmen* is examined for its use of visual motifs, intertextual references, and self reflection to involve its readers in a conversation about the limits of human perception in regards to time and meaning. In particular, the “Hiroshima Lovers” motif, a series of silhouette images of two people embracing, is analyzed to reveal how intertexts and visual motifs divert the reader’s attention to earlier points on the narrative timeline in order to prompt the creation of new interpretations. Further, the motif is used as an example of *Watchmen*’s self-reflexive form in which characters engage in a meaning making process which mirrors that of the reader.



## Savannah Seeger (‘17, Biology)

Dr. Jennifer Bankers-Fulbright

*Pseudomonas aeruginosa* is ubiquitous and causes disease in patients with cystic fibrosis (CF) and those in hospital settings due to the bacteria’stendency to form biofilms. When biofilms form, the bacteria are protected from harmful substances, such as antibiotics or natural anti-bacterial proteins. Thus, once the biofilm has formed within the CF lung, it’s difficult to eradicate and ultimately leads to death. However, people without cystic fibrosis clear the bacteria from their lungs within twenty four hours and prevent the formation of biofilms. Our hypothesis is that there is something in normal lung secretions that stops the biofilm from forming. Although previous data in the lab support this hypothesis, the biofilm assay has been very inconsistent. We report that we have able to successfully establish a robust biofilm assay with the PAO1 strain of *P. aeruginosa* and demonstrate that normal airway secretions significantly inhibit biofilm formation. If the active agent can be identified that are responsible for this action, it’s possible that this could be a treatment for patients with cystic fibrosis.



## Stephanie Magill (‘17, Biology)

Dr. Jennifer Bankers-Fulbright

*Pseudomonas aeruginosa* is relatively innocuous for most people but is the leading cause of mortality in individuals afflicted with the genetic disorder cystic fibrosis (CF). *P. aeruginosa* has two main modes of motility accessible, which are swimming and twitching. Swimming is mediated by the flagella and typically precedes the twitching motility, which is mediated by type IV pili on the surface of the bacteria. Twitching is an environment-specific stimulated motility and is initiated upon flagella shedding. The bacterium then attaches to the surface or neighboring *P. aeruginosa* via the pili and motility proceeds in a multi-cellular coordinated manner. Attachment via pili, and likely twitching motility, is required for subsequent biofilm formation – and thus permanent colonization of the CF lung – by *P. aeruginosa.* In this study I established a functional twitching assay for the PA14 strain of *P. aeruginosa* and began to explore the effects of normal airway secretions on twitching motility. Preliminary results indicate that normal airway secretions do not substantially inhibit twitching motility directly but may affect some aspect of quorum sensing in the PA14 strain.



## Stephen Dols (‘16, Biology)

Dr. Ann Impullitti

Given the economic importance of soybean plants, research is required in order to decrease yield loss due to root rot diseases. Root rot diseases are prevalent throughout the Midwestern U.S. and can be difficult to detect and assess since symptoms are below ground. Therefore, the objective of this investigation was to determine if above ground plant physiological parameters could be used to predict below ground diseases without accessing the root system. We inoculated two varieties of soybean with three known soilborne fungal pathogens *Fusarium solani*, *Fusarium oxysporum*, and *Fusarium virguliforme* and one oomycete, *Rhizoctonia solani.* A portable photosynthesis system was used to measure the light dependent reactions (electron transport rate and fluorescence) and the carbon fixation reactions (photosynthesis and conductance) once per week following inoculation. Below ground symptoms of root rot were readily apparent during experiments, while leaves and stems appeared healthy above ground. We are currently analyzing the physiological data collected throughout the summer and trying to correlate these data with root rot severity.



## Susanna Petaisto (‘15, Psychology)

Dr. Henry Yoon

Previous research from the Minnesota Twin Family Study (MTFS) indicates that significant reduction in the P300 (or P3) brain amplitude indexes youth at risk for externalizing disorders. Specifically, this reduction distinguished 11-year-old subjects with Attention-Deficit Hyperactivity Disorder (ADHD) combined with Oppositional Defiant Disorder (ODD) and/or Conduct Disorder (CD), i.e., “ADHD-comorbid”, but not in those diagnosed with ADHD alone (i.e., “ADHD-pure”). This suggests that the ADHD-comorbid group reflects a severe variant of ADHD at risk for disinhibitory behavioral disorders. In the current study, we examine these groups longitudinally using a community-based sample of uniformed-age MTFS participants. Diagnostic status was determined during intake assessment (age 11). P3 data were collected using the visual rotated-heads oddball task at ages 11, 14, and 17. Brain data will be modeled using growth curves to capture P3 amplitude trajectories associated with each group. Based on previous work, we hypothesized that ADHD-comorbid group trajectories would remain significantly reduced compared to Controls over the approximate 6-year span. Overall, this investigation will further demonstrate that P3 amplitude reduction serves as a developmentally-stable index tapping into a neurobiological substrate associated with behavioral disinhibition.

## Kelsey Merck (’16, Biology)

Dr. Nidanie Henderson-Stull

Protein tags are amino acids of a particular sequence that are incorporated into a protein when it is made. Researchers tag proteins to label them so that they can be easily observed, to target them to specific locations, to block enzymes from digesting them, and to handle specific molecules so that proteins can be easily separated from other protein molecules. Tags are usually engineered at the beginning (N-terminus) or ends (C-terminus) of proteins so where they minimally interfere with their function. In rare instances, such as the protein c-Src, neither terminus is suitable for tagging, making the protein harder to study by these methods. This research project is focused on identifying a novel internal site for tagging the Src protein without disrupting its function. I designed primers to insert a tetracysteine tag into a flexible loop in the Src protein. This presentation describes efforts to introduce this tag into the Src protein.

## Zhou Yang (’16, Economics & Math)

Dr. Stella Hofrenning

**The study of the household’s choice of private versus public schooling is important, because understanding these factors affecting a family’s decision can assist policy makers in educational reform. In recent years, policy analysts have proposed vouchers and grants to encourage private education. These policy instruments effectively reduce tuition for those enrolling their children in private schools. Economic theory suggests that price and income should enter the demand equation for private schools. More specifically, a lower price should raise the amount of private schooling demanded. All else equal, an increase in income will increase the demand for private education. In addition, other factors such as religion, the age and education of the parents, mother’s labor supply, race, gender and the quality of the public schools are introduced in the model to reflect the family’s perception of the costs and benefits of alternative modes of schooling. The model is estimated using data from the American Community Survey (ACS) 2013 on school age children (age 6-17). The analysis reveals a significant negative price effect and a significant positive income effect.**

## Mary Kirchdorfer (‘16, Music)

Dr. Peter Hendrickson

My research project will compare methods of musical analysis by three music theorists, Jean Philippe Rameau, Adolf Bernhard Marx, and Heinrich Schenker. Each theorist lived in a different historical period and their perspectives on musical analysis, performance, and composition are contrasting. I will analyze Muzio Clementi’s Sonatina Op.36, No.1 three times showing each theorist’s unique approach to music analysis. I will show each theorist’s approach on a musical score. Each will visually look different. Many argue that musical analysis will make a musician a better performer, but others have shown that there are excellent performers who do not even know musical analysis exists. I know that the analytical differences on the musical score will be obvious, but I want to explore if the differences can be heard aurally through performance. After researching and analyzing the music in each theorist’s approach, I will record myself three times to see if one can “hear the understanding that comes from music analysis” through my performance.