Women in Science   Clark Science Center

2018

Summer Research Fellowship Project Descriptions 2018

Clark Science Center's Summer Research Fellows Program

Recommended Citation

SURF 2018-Post SURF Survey

Name	Yihui Jiang
Year of Graduation	2020
SURF Advisor	Denise McKahn, Engineering
Advisor Department	Engineering
SURF Field of Study	Engineering

Upload image(s) in .png format; 1,100 MB max size each

YJ figure1.png

YJ figure2.png

Title of Abstract/Research

Please type your abstract below.

Smith College joined the Climate Leadership Network by signing the Carbon Commitment in 2007 and set a target date, 2030, for achieving carbon neutrality. To meet this goal, Smith College is evaluating the feasibility of converting the central heating system to a geothermal heat pump(GHP) system from the existing central heating plant that burns fossil fuels. In order to test the feasibility of installing a GHP system for the whole campus, a building or an area of a smaller scale can be modeled and tested first as a pilot project.

The Field House, next to the athletics field, was chosen as the building to be modeled because it is relatively small, has a recently updated low temperature hot water heating distribution system within the building, and, unlike other buildings which are supplied by Cogeneration Plant, is supplied by an underground boiler that burns heating oil. A small GHP system was designed for the Field House and a model of the heat flow was developed using the modeling software, Trace by Trane. To test the model, sensitivity analysis was done and the heat consumption calculated and compared to the data provided in Grover-Silva's Honors Thesis (2010) as well as Field House Energy Data over a two year period. Sensitivity analysis curve and comparison between Trace data and Grover-Silva's data showed the robustness of the model. However, there are disagreements between Trace data and Field House Energy data which future analysis will examine.

Once the heating load was established, the ground thermal resistance was estimated, as shown in Figure 1, and the geothermal bore depth required to heat and cool the Field House was determined to be 140ft. The normal depth of a borehole is about 400 ft, therefore we concluded that one borehole is sufficient. A sensitivity analysis on the pipe diameter, grout material, fluid flow rate, and borehole configuration was completed to estimate the influence of each parameter on the total thermal resistance of the bore, as shown in Figure 2. The heat pump size was then determined from the peak load and found to be 1.7 tons. Future work will involve further design refinement as well as a grant application to fund the pilot project and further model the mass and energy dynamics to advance controller design and system optimization.

SURF 2018-Post SURF Survey

Name	McKenna Hendrickson
Year of Graduation	2021

Are you in a Graduate program?	no
SURF Advisor	Shannon Audley, Psychology
Advisor Department	Education and Child Study
SURF Field of Study	Psychology
Please list co-authors of your abstract	Joarvi Edwards
Title of Abstract/Research	"You Can't Hate on Someone Who Helps": How Teachers Earn The Respect of Adolescent Students

Please type your abstract below.	"You Can't Hate on Someone Who Helps": How Teachers Earn The Respect of Adolescent Students

Despite the increasingly recognized need of students to feel cared for in order to succeed in school, most new teachers struggle to find balance between being an authoritative and caring figure (McLaughlin, 1991). Much of this disconnect between the needs of students and the classroom management tools novice teachers utilize stems from a lack of research on how students come to respect their teachers. A better understanding of how teachers earn their students' respect will help teachers develop strategies for balancing caring and respect. This study applies qualitative analysis methods to high school students' stories of teachers earning their respect as a means of identifying the processes that cause students to respect teachers.

Employing a Critical Race Theory framework, we were interested in how the social locations of students and their teachers shaped the respect-earning process (Ladson-Billings, 1998). To achieve this goal, we inductively coded the interviews and found 3 themes: microresistance, descriptions of respectful teachers, and respectful actions (See attached figure). We categorized microresistances as either microaffirmations (actions from teachers which affirmed students' social identities) or microoppositions (actions from teachers which refuted microaggressive behavior).

Participants were 16 high school students from grade 9-12, and were conducted in after school programs in Oakland, California and Western Massachusetts. We created a codebook analyzing the students' stories about a teacher earning their respect. Our coding investigated multiple aspects of the respect earning process, such as who witnessed the respect earning event or the students' emotional response.

Preliminary results show that both white students and students of color cited helpfulness and caring from teacher as an important to earning their respect. White students were more likely than students of color to discuss teachers supporting their autonomy as a reason for earning their respect, while students of color were much more likely to say that microaffirmations and microresistances earned their respect. Microresistance stories were primarily told by female students of color. The most common type of microresistance stories was microaffirmations.

Promoting respect in STRs is not a simple task, and can be especially complicated where there is an ethnic mismatch between the student and teacher. We hope that research like ours examining the respect earning process can help inform teacher education programs. This research will continue throughout the 2018-2019 academic year.

References

Ladson-Billings, G. (1998). Just what is critical race theory and what's it doing in a nice field like education?. International Journal of Qualitative Studies in Education, 11(1), 7-24. https://doi.org/10.1080/095183998236863

McLaughlin, H. J. (1991). Reconciling care and control: Authority in classroom relationships. Journal of Teacher Education, 42(3), 182-195. https://doi.org/10.1177/002248719104200304

SURF 2018-Post SURF Survey

Name	Xufen Liu
Year of Graduation	2020

Are you in a Graduate program?	no
SURF Advisor	Non-Smith Advisor
If your SURF Advisor was not listed above you can enter their name here.	Jesse Bellemare
Advisor Department	Biological Sciences
SURF Field of Study	Ecology
Title of Abstract/Research	Biogeography and phylogeography of Jeffersonia diphylla populations in the eastern United States

Please type your abstract below.

The Last Glacial Maximum (~18,000 years ago) profoundly influenced the geographical distribution of plant and animal species, as well as the genetic diversity within those species. Despite many 1000s of years of migration and range expansion, some of these patterns might persist down to the present. In particular, it is expected that higher levels of diversity and unique genotypes will be concentrated in southern areas (former glacial refugia), while northern areas may be less diverse. For this study, I worked on Jeffersonia diphylla, a forest understory species growing across the eastern U.S. The species has ant-dispersed seeds, so it is expected to have limited dispersal ability, which may affect patterns of distribution and genetic diversity. I hypothesized that there would be higher genetic diversity and more phylogenetically distinct lineages in the southern parts of its range in Georgia, Alabama, and Tennessee, compared to northern areas, like Minnesota, Michigan, and New York. By assessing the genetic diversity of and reconstructing the phylogenetic relationship among the populations of Jeffersonia diphylla across the country, I tested the hypothesis of the species' distribution pattern and got a better understanding of the historical processes that might have shaped the modern distribution patterns and diversity of this species.

Sequences of the trnL gene and trnL-trnF intergenic spacer, which is a chloroplast DNA marker, were developed from leaf samples collected from populations across the species' distribution range in the eastern US. I detected several distinct chloroplast DNA haplotypes and, as predicted, most of the haplotype diversity was present in southern populations near the species range edge, while the mid-range and northern populations were all genetically identical at the marker tested. This suggests that populations in parts of Georgia and Alabama have been distinct and isolated from populations in the remainder of the species' geographic range since at least the late Pleistocene. The pattern also suggests that these distinctive populations might be of significant conservation value in terms of overall genetic diversity in the species. In the light of impending climate change, which is likely to negatively affect southern populations first, efforts should be made to better understand diversity in these southern areas.

Additionally, during my SURF this summer, I worked with Taryn Mueller on a project investigating the symbiotic relationship between Rhododendrons and specialized soil fungi. I measured the leaf length of the Rhododendron seedlings from different experimental treatments to assess rates of seedling growth with and without symbiotic root fungi. I also sampled the soil under adult Rhododendron maximum in the field and used light microscopy to evaluate the level of root colonization by fungi in the experimental Rhododendron seedlings.

Name	Joarvi Edwards
Year of Graduation	2020

SURF Advisor	Non-Smith Advisor
If your SURF Advisor was not listed above you can enter their name here.	Shannon Audley, Education & Child Study
Advisor Department	Education and Child Study
SURF Field of Study	Education & Child Study
Please list co-authors of your abstract	McKenna Hendrickson

Upload image(s) in .png format; 1,100 MB max size each	

Title of Abstract/Research	"You Can't Hate on Someone Who Helps": How Teachers Earn The Respect of Adolescent Students
Please type your abstract below.	Despite the increasingly recognized need of students to feel cared for in order to succeed in school, most new teachers struggle to find balance between being an authoritative and caring figure (McLaughlin, 1991). Much of this disconnect between the needs of students and the classroom management tools novice teachers utilize stems from a lack of research on how students come to respect their teachers. A better understanding of how teachers earn their students' respect will help teachers develop strategies for balancing caring and respect. This study applies qualitative analysis methods to high school students' stories of teachers earning their respect as a means of identifying the processes that cause students to respect teachers. Employing a Critical Race Theory framework, we were interested in how the social locations of students and their teachers shaped the respect-earning process. To achieve this goal, we inductively coded the interviews and found 3 themes: microresistance, descriptions of respectful teachers, and respectful actions (See attached figure). We categorized microresistances as either microaffirmations (actions from teachers which affirmed students' social identities) or microoppositions (actions from teachers which refuted microaggressive behavior). Participants were 16 high school students from grade 9-12, and were conducted in after school programs in Oakland, California and Western Massachusetts. We created a codebook analyzing the students' stories about a teacher earning their respect. Our coding investigated multiple aspects of the respect earning process, such as who witnessed the respect earning event or the students' emotional response. Preliminary results show that both white students and students of color cited helpfulness and caring from teacher as an important to earning their respect. White students were more likely than students of color to discuss teachers supporting their autonomy as a reason for earning their respect, while students of color were much more likely to say that microaffirmations and microresistances earned their respect. Microresistance stories were primarily told by female students of color. The most common type of microresistance stories was microaffirmations. Promoting respect in STRs is not a simple task, and can be especially complicated where there is an ethnic mismatch between the student and teacher. We hope that research like ours examining the respect earning process can help inform teacher education programs. This research will continue throughout the 2018-2019 academic year. References Ladson-Billings, G. (1998). Just what is critical race theory and what's it doing in a nice field like education?. International Journal of Qualitative Studies in Education, 11(1), 7-24. https://doi.org/10.1080/095183998236863 McLaughlin, H. J. (1991). Reconciling care and control: Authority in classroom relationships. Journal of Teacher Education, 42(3), 182-195. https://doi.org/10.1177/002248719104200304

SURF 2018-Post SURF Survey

Name	Xiying Deng
Year of Graduation	2021

Are you in a Graduate program?	no
SURF Advisor	Judith Cardell, Engineering
Advisor Department	Engineering
SURF Field of Study	Electric Power System
Title of Abstract/Research	Demand Response and Electric Vehicle Charging

Please type your abstract below.

A steady frequency of the electricity network is crucial to the proper functioning of most appliances. In the US, the electric grids are required to transmit power at a frequency of 60 Hz with little deviation. However, when there is a sharp increase in demand in a region, if the demand exceeds the generation capacity, it can be difficult to regulate the frequency at a steady rate. Demand response is an increasingly important solution to relieve the stress of the electric grid during peak hours without building additional power plants. Usually incentive-based, the demand response programs incorporate the electricity customers as part of the electricity resources. During peak demand, the group of customers participating demand response will reduce their electric usage by shifting the load to a different time. Thus, the stress on the grid during peak hours is relieved. Furthermore, demand response encourages higher penetration of clean energy. Because wind and solar energy are subject to more uncertain factor, high penetration of clean energy into the grid has been difficult. The demand response programs can compensate on the variability of clean energy.

This summer, I reviewed the literature on the integration of clean energy, demand response, and the electric grid. I learned the working mechanism of the electricity market, the basic elements of the electric grid, the factors that maintain a reliable grid, and how demand response facilitates the integration of clean energy. I assisted professor Cardell in collecting the data on demand response of different Independent System Operators (ISOs), including reviewing demand response policies and contracts, demand response customer distribution, and evaluation of current demand response programs' result.

In addition, I look at the literature on scheduling electric vehicle charging through demand response and the home energy management system (HEM). Shifting EV charging to low demand period prevents additional stress on the electric grid during peak hours. The home management system schedule electric vehicle charging that is connected to the house in order to maintain a lower total energy usage within the house during the hours when the community's demand reaches its peak at around 7-9 pm. I reviewed current models and algorithms for scheduling EV charging and HEM control strategies. To mimic EV charging, I designed a similar model on phone charger using Arduino. The device includes an Arduino UNO controller, a keypad and an LCD for input and display, and a relay for switching the charger on and off. The device applies the market price as a reference for scheduling the charging process. It shifts the charging of the phone from higher-priced periods to lower-priced periods. The device also takes the customer's intended charging time and state of charge curve of the phone battery into account. The incorporation of demand response in EV charging has great significance to cities that have high plug-in electric vehicle penetration and to the development of incorporating of demand response in individual houses.

SURF 2018-Post SURF Survey

Name	Kirstin DiMauro
Year of Graduation	2020

Are you in a Graduate program?	no
SURF Advisor	Stylianos Scordillis, Biochemistry
Advisor Department	Biochemistry
SURF Field of Study	Proteomics

Upload image(s) in .png format; 1,100 MB max size each
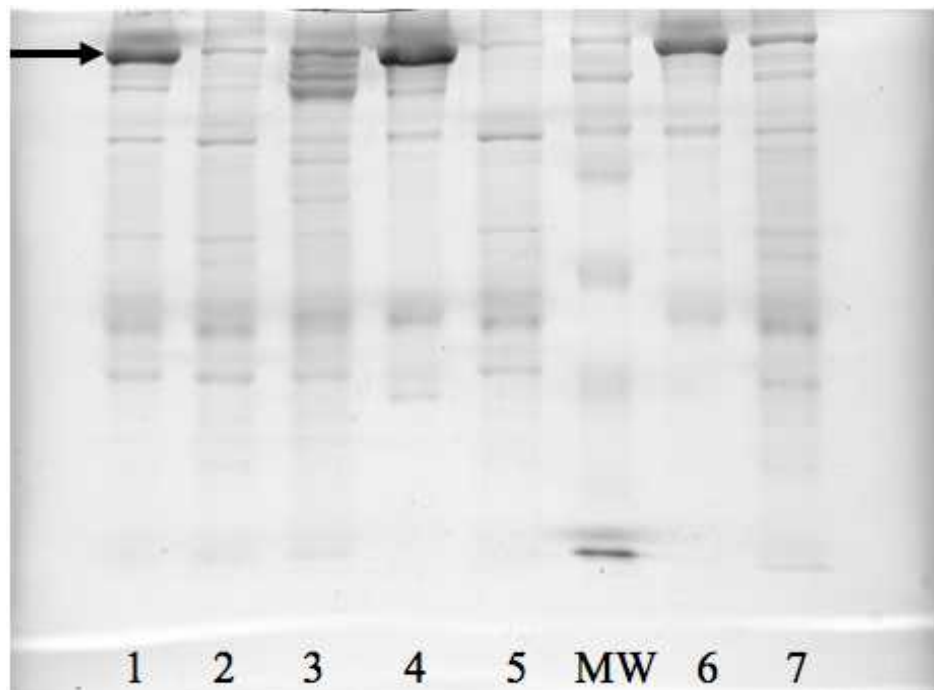
Figure 1: SDS-PAGE comparing 20 µg protein from the four extraction buffers: rat gastrocnemius (lanes 1-5) and mouse biceps brachii (6-7). 1: KCl; 2: RIPA; 3: Urea/Thiourea; 4 (pellet)-5 (supernate): method [4] rat muscle; 6-7: mouse muscle.

K DiMauro Figure 1.png

Method	Protein IDs	Buffer
1	1003	High Ionic Strength
2	1266	RIPA
3	981	Urea/Thiourea
4	1669	Sarcomeric/Soluble

Table 1: Proteins identified in each of the four extraction methods – methods indicated in text.

K DiMauro Table 1.png

Title of Abstract/Research

Optimal Protein Extraction for Whole-Proteome Analysis

Please type your abstract below.

Tandem Mass Tag (TMT) Systems enable the relative quantitation and identification of protein samples labeled with isobaric mass tags through high pressure liquid chromatography-coupled mass spectrometry (LC/MS) analysis. This study used TMT 6-plex amine-reactive reagents to assess the most efficient method to analyze the proteome of murine skeletal muscle. Four commonly used protein extraction buffers: [1] high ionic strength KCl (0.5 M KCl, 15.0 mM Tris-HCl pH 7.4, 1.0 mM EDTA, 10 mM Na pyrophosphate with protease and phosphatase inhibitors (PPI); [2] RIPA (25mM Tris-HCl pH 7.6, 150 mM NaCl, 1% NP-40, 1% sodium deoxycholate, 0.1% SDS with PPI; [3] Urea/Thiourea 6 M urea, 2 M thiourea, 1 mM DTT with PPI; and [4] sarcomeric versus soluble (10 mM NaPO4 buffer pH 7.0, 2 mM EDTA, 10 mM NaN3, 140 mM NaCl, 1% NP-40 PPI, were used to extract the same rat muscle and analyzed for the protein identities that were captured. The resulting extracts were acetone precipitated twice and aliquots had their concentrations estimated using the Lowry Assay. Samples and visualized using SDS-PAGE. The gel confirmed differential protein extraction (Figure 1). The RIPA extraction yielded a lower amount of high molecular weight myosins (arrow) than the rest of the extractions (Figure 1). Aliquots were then reduced, alkylated, and digested with trypsin before being labeled with TMT reagent. TMT-labeled samples were further separated using the Pierce High-pH fractionation method to maximize protein identification during LC/MS analysis. The sarcomeric versus soluble extraction method [4] yielded the most proteins (Table 1). There is significant overlap between method [4] and the others which is to be expected. Method [4] was chosen for whole-proteome analysis of gender dimorphism in exercise-naïve murine skeletal muscle. This study is in progress and will be analyzed in comparison to previous work from our laboratory (Metskas, L. A., M. Kulp and S. P. Scordilis. Gender Dimorphism in the Exercise-naïve Murine Skeletal Muscle Proteome, Cell Molec Biol. Lett., 15: 507-516, 2010) done by two-dimensional gel proteomic analysis.

SURF 2018-Post SURF Survey

Name	Mercedes Woolley
Year of Graduation	2020

Are you in a Graduate program?	no
SURF Advisor	Randy Frost, Psychology
Advisor Department	Psychology
SURF Field of Study	Psychology
Please list co-authors of your abstract	Molly Eldevik '19, Becky Braverman '20-J
Title of Abstract/Research	Predictors of Outcome in the Buried in Treasures Workshop for Hoarding
Please type your abstract below.	The Buried in Treasures Workshop (BIT) is a biblio-based treatment group for individuals who struggle with excessive hoarding, saving, and acquiring of possessions. Members of the BIT group meet weekly for a session facilitated by a clinician or trained peer. Each session focuses on a chapter of Tolin et al.'s (2014) Buried in Treasures: Help for Compulsive Acquiring, Saving, and Hoarding, which guides participants through the process of confronting and managing their hoarding problems. Previous research has found that participating in the BIT workshop significantly reduced hoarding behavior compared to a waitlisted group (Frost et al., 2011; Frost et al., 2012)and that the effects of the BIT workshop are comparable to those of cognitive behavioral therapy (Mathews et al., 2014). Despite this empirical support, many members of the BIT workshop still struggle with hoarding following treatment. This research aims to identify the predictors of success in the BIT workshop to potentially improve the program and reduce the difficulty experienced by participants post-treatment. This study examined 56 individuals who completed the BIT workshop in Santa Monica, California and Northampton, Massachusetts. Sixteen sessions took place over a period of four months. The participants responded to two measures of hoarding symptomology, the Savings Cognition Inventory (SCI) and the Saving Inventory Scale-Revised (SI-R), before and after treatment. Pretest and posttest scores were compared using a general linear model and linear regressions were used to examine the effect of pretreatment saving cognitions and changes in saving cognitions on hoarding symptoms. The analysis showed significant decreases in hoarding symptoms and beliefs (p's < .001). Correlations between percent change in hoarding symptoms and pretest SCI scores revealed significant and positive correlations between hoarding symptoms and SCI Emotional Attachment. Linear regression analysis revealed

that higher pretreatment scores on the Emotional Attachment subscale of the SCI predicted lower posttest scores on the SI-R total, the SI-R Difficulty Discarding subscale, and the SI-R Clutter subscale after controlling for pretext scores on the SI-R. Changes in saving cognitions (SCI) were correlated with changes in hoarding symptoms (SI-R). Of the 16 correlations, 14 were significant. SCI Responsibility showed the strongest correlations (rs from .33 to .55). Linear regression analysis showed that pretest to posttest changes in SCI Responsibility predicted a lower total score on the SI-R and lower scores on the SI-R Difficulty Discarding subscale and the SI-R Excessive Acquisition Subscale after controlling for pretest values and the other SCI subscales. Only change in SCI Memory predicted lower SI-R clutter. These findings suggest that individuals with heightened feelings of responsibility for possessions may achieve a better outcome in the BIT workshop than those who experience heightened emotional attachment, memory, or a need to control possessions. These results are consistent with research on the importance of waste avoidance as a fundamental mechanism in hoarding disorder (Dozier & Ayers, 2014; Frost et al., 2015). Further measurement of changes in SCI Responsibility is needed to establish whether these changes mediate changes in the SI-R. References: Dozier, M.E. & Ayers, C.R. (2014). The predictive value of different reasons for saving and acquiring on hoarding disorder symptoms. Journal of Obsessive-Compulsive and Related Disorders, 3, 220-227. Frost, R. O., Pekareva-Kochergina, A., & Maxner, S. (2011). The effectiveness of a biblio-based support group for hoarding disorder. Behaviour Research And Therapy, 49(10), 628-634. doi:10.1016/j.brat.2011.06.010 Frost, R. O., Ruby, D., & Shuer, L. J. (2012). The buried in treasures workshop: Waitlist control trial of facilitated support groups for hoarding. Behaviour Research And Therapy, 50(11), 661-667. doi:10.1016/j.brat.2012.08.004 Frost, R.O., Steketee, G., Tolin, D.F., Sinopoli, N., & Ruby, D. (2015). Motives for acquiring and saving in hoarding disorder, OCD, and community controls. Journal of Obsessive-Compulsive and Related Disorders, 4, 54-59. Mathews, C., Uhm, S., Chan, J., Gause, M. Franklin, J., et al. (2016). Treating hoarding disorder in a real-world setting: Results from the mental health association of San Francisco. Psychiatry Research, 237, 331-338. Tolin, F.D., Frost, R. O., & Steketee, G. (2014). Buried in Treasures: Help for Compulsive Acquiring, Saving, and Hoarding (2nd ed.). New York, NY: Oxford University Press. (Supported by SURF Fund) Advisor: Randy O. Frost

SURF 2018-Post SURF Survey

Name	Emily Fitzgerald **Smith**
Year of Graduation	2020
Are you in a Graduate program?	no
SURF Advisor	Maren Buck, Chemistry
Advisor Department	Chemistry
SURF Field of Study	Polymer Chemistry
Upload image(s) in .png format; 1,100 MB max size each	
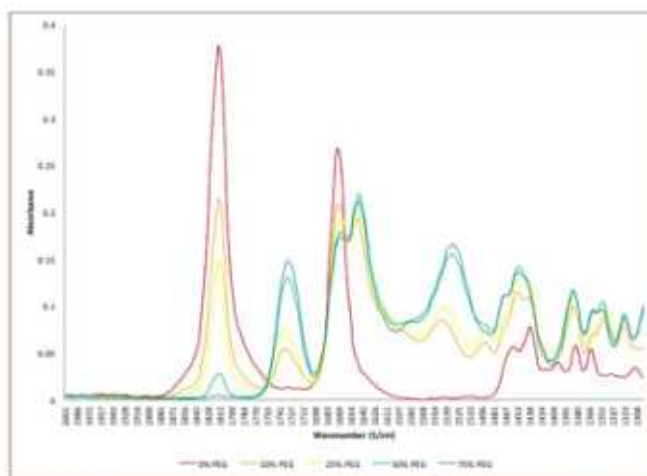
Figure 1. Wavelength vs. Absorbance spectra for PEG-400 gels of various crosslinking densities. The key peak is at 1820 cm^{-1}, which represents remaining azlactone rings in the gel matrix. As crosslinking density increases, the azlactone peak diminishes.

EFitzgeraldFig1.png
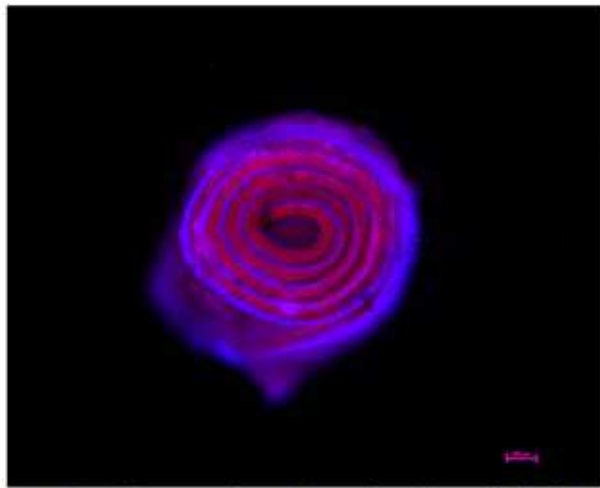
Figure 2. A bilayer gel consisting of a 10% crosslinked PEG-2000 layer labeled with dansylcadaverine and a 75% crosslinked PEG-400 layer labeled with tetramethylrhodamine. Both layers were cast at a height of ~24µm. Image taken on a Nikon Eclipse Ti-S Light Microscope at a 100µm scale.

EFitzgeraldFig2.png
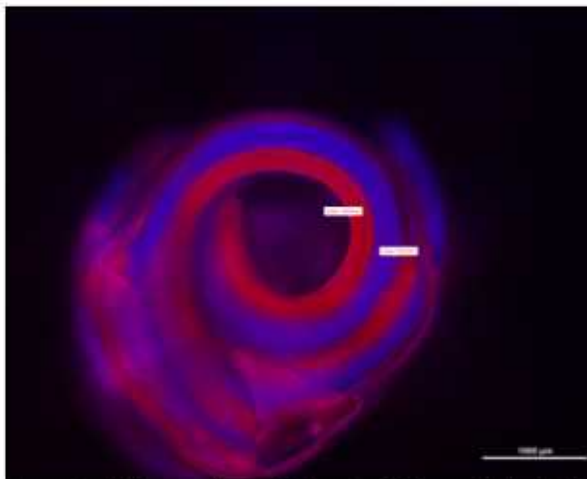
Figure 3. A bilayer gel consisting of a 10% crosslinked PEG-2000 layer labeled with dansylcadaverine and a 75% crosslinked PEG-400 layer labeled with tetramethylrhodamine. Both layers were cast at a height of ~170µm. Image taken on a Nikon Eclipse Ti-S Light Microscope at a 1000µm scale.

EFitzgeraldFig3.png

| **Title of Abstract/Research** | Cells on Gels: Behavior of Self-Rolling PEG/PVDMA Bilayer Gels |

Please type your abstract below.

Polymeric hydrogels offer potential as scaffolds for tissue engineering and three-dimensional cell culture. This summer, I experimented with PVDMA hydrogels crosslinked with polyethylene glycol (PEG). PEG is an FDA-approved diol that is inexpensive and readily available. Variables to be considered included crosslinking density, PEG molecular weight, and post-gelation chemical functionalization. Prior research has focused on gels crosslinked with Jeffamine, a diamine, so my initial goal was to demonstrate that PEG gels behave comparably to Jeffamine gels. Using FTIR data, I found that crosslinking density could be altered depending on the molar ratio of PEG to PVDMA (Fig. 1) and that PEG gels could be functionalized post-gelation, similarly to Jeffamine gels. Beyond characterization and comparison, I attempted to optimize gel-casting protocols to guarantee consistency between gels. I conducted gelation time studies to identify the optimal length of time to cast gels to allow for complete gelation, yet avoid hydrolysis and wasted time. However, due to the necessity of a small amount of catalyst to deprotonate PEG during gelation, the amount of which impacts the kinetics of gelation, it was too difficult to ensure consistent enough catalyst concentrations or uniform mixing, and the data proved inconclusive.

I then moved on to casting bilayer PEG gels, one layer crosslinked with PEG-400 and one layer crosslinked with PEG-2000, demonstrating that differential swelling between the two layers in a PEG gel will result in the gel curling in on itself, as is the case with Jeffamine bilayer gels. In tandem with the summer research of Buck lab member, Savannah Pees, I cast an array of PEG gels and observed their rolling behavior, altering variables such as the crosslinking densities of each layer and layer height. Labeling the PEG-400 layer with TMR and the PEG-2000 layer with dansylcadaverine, we were able to fluorescently image cross-sections of our gels on a Nikon Eclipse Ti-S Light Microscope. Gels cast with a layer height of ~24 ⌐ m had a smaller inner diameter and several more turns than gels cast with a layer height of 170 ⌐ m (Fig. 2 and 3). Regarding crosslinking densities, the gels that rolled the tightest had PEG-400 layers crosslinked 75% or 50% and PEG-2000 layers crosslinked 10% or 25%. Further research will expand into various chemical functionalizations of bilayer gels and their effect on rolling behavior. Ultimately, we plan to use these self-rolling bilayer gels as a method of cell encapsulation, allowing the tunable chemical, physical, and mechanical properties of the gels to influence cell behavior.

SURF 2018-Post SURF Survey

Name	Kiev Gambrell **Smith**
Year of Graduation	2020

Are you in a Graduate program?	no
SURF Advisor	Denise McKahn, Engineering
Secondary SURF Advisor	Dano Weisbord
Advisor Department	Engineering
SURF Field of Study	Engineering

| **Upload image(s) in .png format; 1,100 MB max size each**	
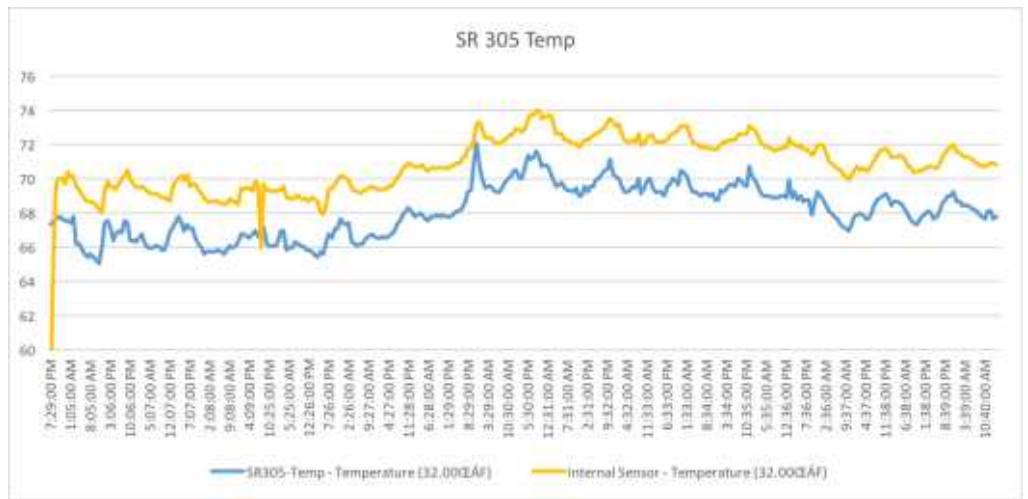
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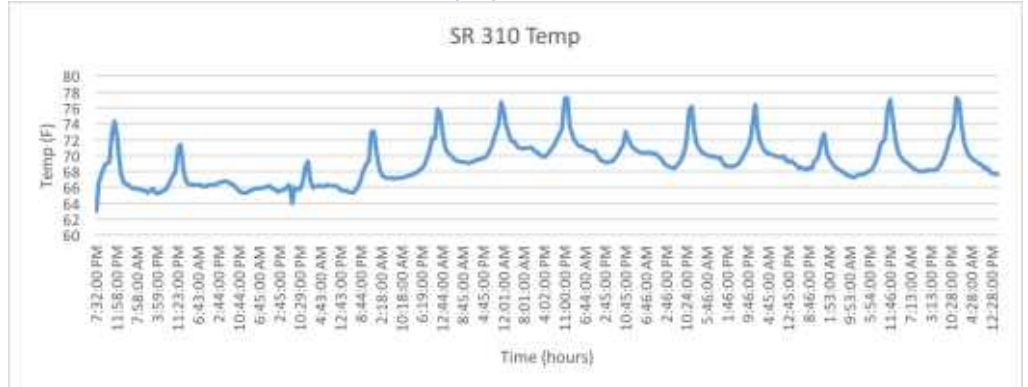
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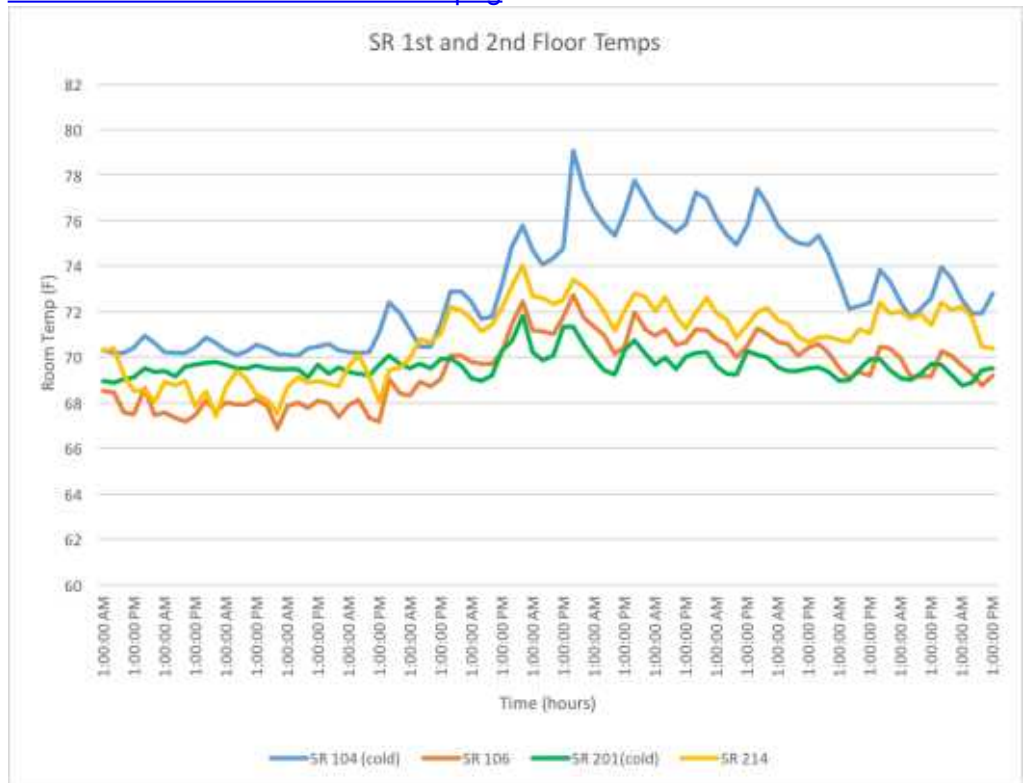
K. Gambrell-Sabin Reed 1st and 2nd Floor Data.png |
| **Title of Abstract/Research** | Energy Usage and Environmental Programming at Smith College |

Please type your abstract below.

This summer, I explored three different projects related to campus energy and environmental concerns at Smith College. The first project involved the collection of temperature data for various rooms in Sabin-Reed hall. The second project involved a collaboration with the Smith College Energy Management team. Lastly, the third project was a research-based project on peer-to-peer environmental programming at other institutions. My research examined how the effectiveness of these environmental programs was evaluated and how Smith could incorporate other programming ideas from other schools.

Regarding the first project, work orders from previous years were used to determine which rooms in Sabin-Reed received complaints for unusually cold temperatures. Three floors were examined in this project; one room per floor was used as an experimental "cold" room. Then, one room on each floor that had not received complaints in the work orders was chosen at random to serve as a comparison room. Once the rooms were identified, one sensor was placed in each room. The cold rooms were observed for two weeks and the data was analyzed using graphs generated on Excel.

For the second project, I worked with Smith's Energy team to conduct research on different types of energy management software. The energy management team wanted to find a software that would make the bill data entry process more efficient and include features that can find trends in the bill data and identify billing errors. I conducted research on different companies and initiated communication with them about how their software could meet Smith's needs. Then, I would schedule live demonstrations of the software with the software representatives and the Smith Energy team. We decided that Schooldude software would be the best solution for Smith because of its ability to process comprehensible data.

Finally, the goal of the third project was to conduct research on peer-to-peer environmental programming at other institutions and to examine the effectiveness of these programs. The Sustainability Tracking, Assessment and Rating System (STARS) database has developed a criteria to determine the effectiveness of the programs and to compare programs at different schools. Once the initial research was completed, I developed a spreadsheet of programming ideas from other institutions that I felt could be implemented at Smith or that could improve the quality of Smith's programming.

In conclusion, the projects I worked on this summer supported my interests in renewable energy and allowed me to explore energy usage at Smith.

SURF 2018-Post SURF Survey

Name	Wiktoria Leks **Smith**
Year of Graduation	2019

Are you in a Graduate program?	no
SURF Advisor	Michael Baressi, Biological Sciences
Secondary SURF Advisor	Naren Pathak
Advisor Department	Chemistry
SURF Field of Study	Developmental Biology
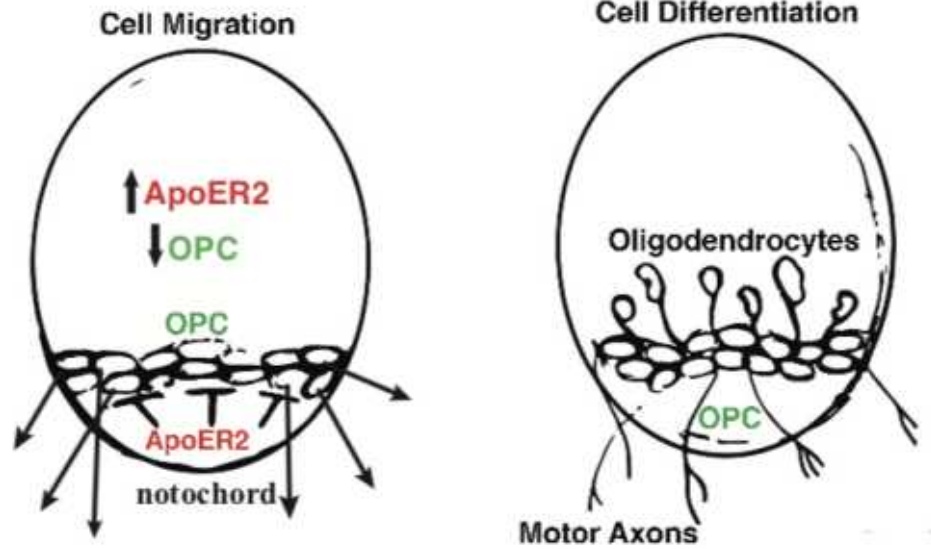
Upload image(s) in .png format; 1,100 MB max size each	 Screen Shot 2018-04-10 at 2.03.36 PM.png Screen Shot 2018-07-16 at 2.37.03 PM.png
Title of Abstract/Research	Gene to behavior: An investigation of Reelin signaling during development of the nervous system in zebrafish.
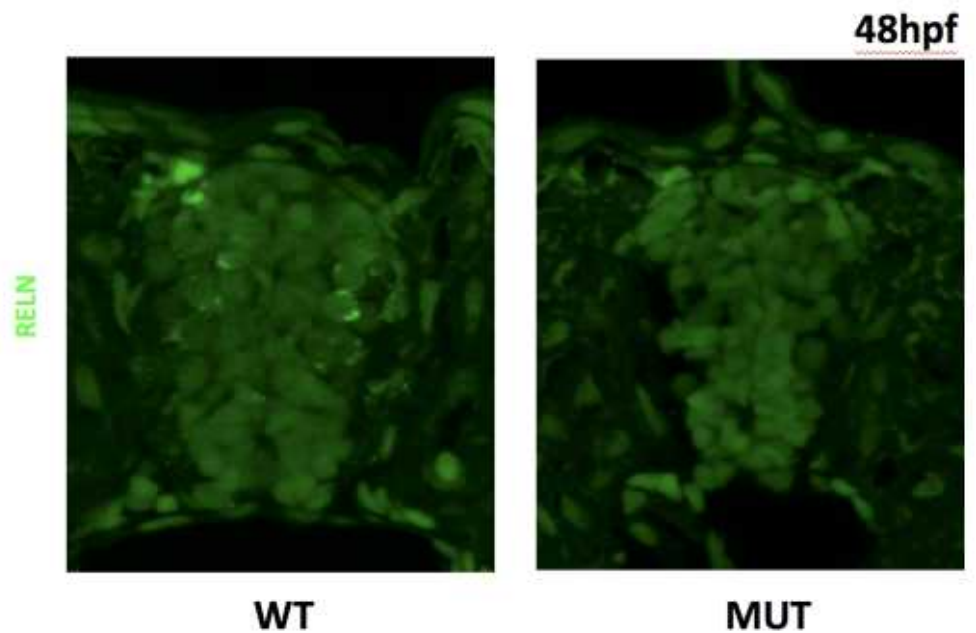
Please type your abstract below.

Reelin is a large secreted glycoprotein, crucial for directing cell migration in the developing brain through the establishment of cortical cellular layers and synaptic activity. Reelin performs intracellular signaling with neuron and glia cells by binding to two lipoprotein receptors, either Apolipoprotein-E receptor 2 (ApoER2), or Very low density lipoprotein receptor (Vldlr), which as a result activates the intracellular adaptor Disabled 1 (Dab1) by tyrosine phosphorylation1. Activated Dab1 receives cues from the environment to regulate neurite growth cone extensions, cortical neuronal migration, cell fate specification and radial glial morphology.

To better understand the role of Reelin signaling during embryonic brain development we have taken advantage of CRISPR/CAS9 technology to generate nonsense mutations yielding viable null-mutants in key molecular players composing the Reelin signaling pathway. In particular, for Reelin, it's receptors ApoER2 and Vldlr, Dab1, GFAP and Meteorin in order to create a total loss of function approach implemented in Zebrafish as the animal model due to its unique combination of transparent, rapid, and extrauterine development. The CRISPR/CAS9 system induces double stranded breaks in an assigned location of the DNA, leading to an ideally unsuccessful repair process known as non-homologous end joining.

The majority of research about Reelin focuses on cell migration with still images of the brain. However, little investigation has been done on the role of Reelin in conjunction with Reelin's receptors, which are involved in cellular processes such as neuronal proliferation, differentiation and migration. The zebrafish spinal cord is an advantageous simple model to study neural development due to a limited number of neuron and glia cell type. We specifically examined the brain's functional and structural deficits associated with our gene of interest's expression within the cerebellum, eyes, forebrain, and hindbrain. This was achieved through cutting cross sections of our mutants' brain morphology as well as various imaging techniques, microscopy, and via in situ. Behavioral analysis of the locomotor movement of reelin mutants shows a decrease in average waking activity as compared to wildtype. Further investigation to link the of the specific cellular and behavioral defects in the Reelin pathway mutants will uncover new insight into the function of Reelin during conventional development, and more significantly its contribution in neurodevelopmental disease pathogenesis.

SURF 2018-Post SURF Survey

Name	Kareen Seignon
Year of Graduation	2019

Are you in a Graduate program?	yes
SURF Advisor	Steven Williams, Biological Sciences
Secondary SURF Advisor	Jessica Grant
Advisor Department	Biological Sciences
SURF Field of Study	Biology
Please list co-authors of your abstract	
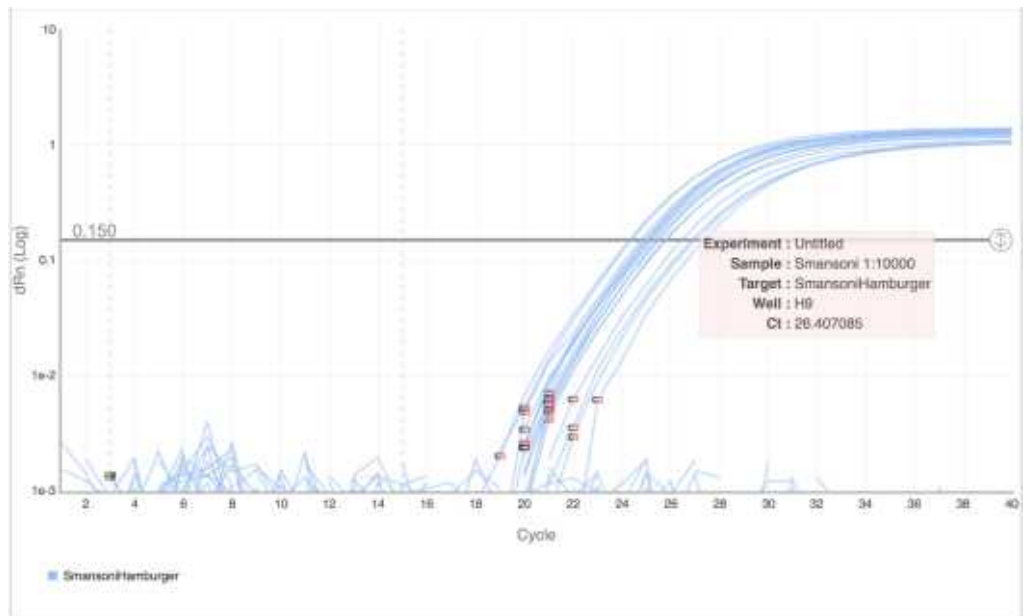
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	Screen Shot 2018-09-06 at 9.29.31 PM kseignon Smansoni amplification (left picture).png
	Screen Shot 2018-09-06 at 9.41.39 PM kseignon _Shaematobium no amplification (right picture).png
Title of Abstract/Research	Development of a Sensitive Quantitative PCR Assay for the Detection of Schistosoma mansoni in Patients
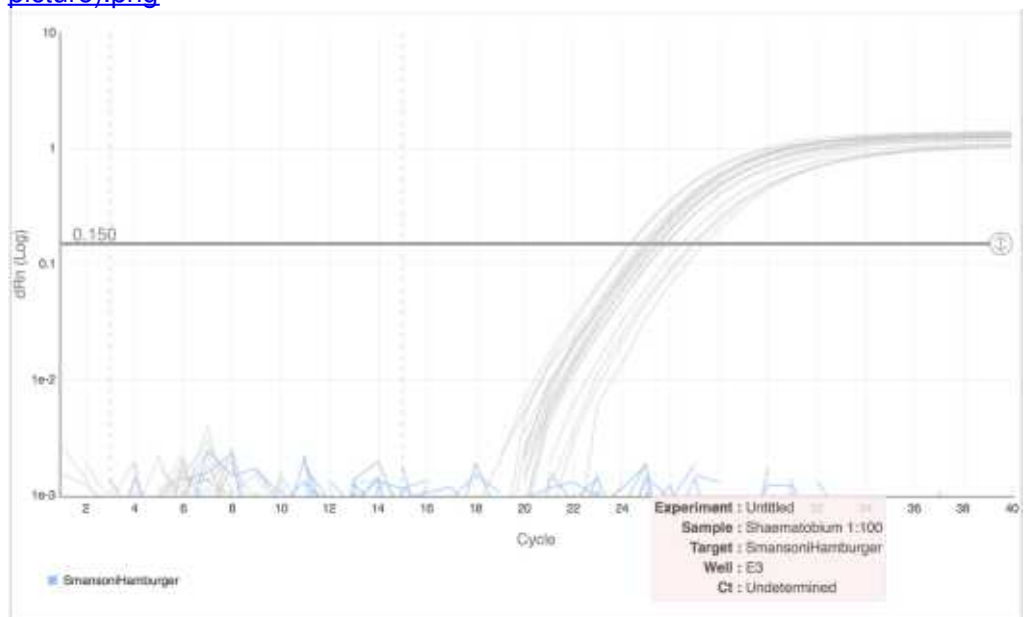
Please type your abstract below.

Schistosomiasis is a neglected tropical disease (NTD) that affects more than 200 million people around the world. One of the most important causative agents is the parasitic nematode Schistosoma mansoni.1 Infection occurs when larvae found in freshwater lakes and streams penetrate the skin of a human host. Inside the host, the parasite reaches maturation and lays eggs in the human gut, which are expelled via fecal matter.2 The accumulation and dispersion of these eggs in the gut and other organs can cause complications including heart failure, epileptic convulsion, and pulmonary arteritis.3 Schistosomiasis is one of the NTDs set by the World Health Organization (WHO) to be eliminated by 2020 through mass drug administration (MDA) efforts.4 A sensitive diagnostic test is necessary to the success of the MDA effort in order to identify endemic regions where treatment for schistosomiasis is needed.5

The goal of my research is to design a real-time PCR based diagnostic assay that is highly sensitive and specific at detecting S. mansoni in human stool. Different bioinformatics tools were used to identify highly repetitive non-coding DNA sequences in the genome of the parasite and to design forward and reverse primers and a probe to target and amplify these repeat elements. The high copy number of these non-coding DNA sequences makes the test highly sensitive as it is easy for these primers and the probe to find these sequences and hybridize to them. Moreover, these repetitive non-coding DNA sequences tend to be unique to each species. This feature makes the test highly specific to the parasite. 6 The optimal concentrations and annealing temperature at which the forward and reverse primers are more effective at amplifying the S. mansoni DNA were determined. The specificity of the assay was also tested by using the assay intended for the S. mansoni DNA on S. haematobium DNA, one of the species most closely related to S. mansoni. The specificity test showed no amplification of the S. haematobium DNA even at a higher concentration relative to a low concentration of S. mansoni DNA (Figure 1).

The next step is to do a spiking study by mixing different concentrations of S. mansoni and S. haematobium eggs with sterile human stool samples. DNA isolation will be performed on these mixtures, and the real-time PCR assay for S. mansoni will be tested for sensitivity and specificity on these samples.

Figure 1. Real-time PCR amplification plot showing the amplification of a 1:10000 dilution of S. mansoni DNA (left) and no amplification of 1:100 dilution of S. haematobium DNA (right)

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(https://www.sciencedirect.com/science/article/pii/B9780323034548500437)
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SURF 2018-Post SURF Survey

Name	Zhiqi Sun
Year of Graduation	2020

Are you in a Graduate program?	no
SURF Advisor	Julianna Tymoczko, Mathematics and Statistics
Advisor Department	Mathematics and Statistics
SURF Field of Study	Math
Title of Abstract/Research	Closure relationships between Springer fibers that Correspond with Non-Crossing Matchings

| **Please type your abstract below.** | The Springer fibers of a matrix X is the set of flags V. ={V1,V2, …,Vn} such that $XV_i \subseteq V_i$ for all $0 \le i \le n$. Non-crossing matching is a type of graph, where 2n dots are connected such that each dot is matched to one and only one other dot and no matching crosses. Earlier study on Springer fibers of matrices with 2 by 2 Jordan blocks on the diagonal reveals a unique one-to-one correspondence between the maximal cells and non-crossing matchings. This study focus on the closure relationships between these maximal cells. We can arrange the non-crossing matchings from the least nested level to the most nested level and we propose that if a matrix A of a more nested level can be obtained by operating on a matrix B of a less nested level, then A and B form a closure relationship.

We defined an operation on the non-crossing matching diagram as unfolding a pair of nested arcs into two non-nested arcs. Using previous algorithm, we discovered that when looking at the change on the corresponding cells, one operation is equivalent to switching a cycle of the corresponding consecutive columns, under the assumption that the free variables representing inner arcs are always way larger than the free variables representing their ancestor/outer arcs. As a result of such switching, one maximal cell can be permuted into a lower dimensional version of another maximal cell that has less nested structure and thus, these two cells form a closure relationship. On top of this, we also found that based on the necessary switchings from cell A to cell B, we can recover the path from non-crossing matching A to non-crossing matching B on the nested level diagram, which suggests that there is a one-to-one correspondence between the switch on the cells and the operations on the graph.

In the future, I'm hoping to prove that this closure relationship can be generalized to any arbitrary n by n case and that the same result holds for the arc-and-ray diagrams, as the cells should not change when we operate on two rays. |

SURF 2018-Post SURF Survey

Name	McKensie Murray
Year of Graduation	2021

Are you in a Graduate program?	no
SURF Advisor	Non-Smith Advisor
If your SURF Advisor was not listed above you can enter their name here.	Nuru Stracey, she is a Smith Professor
Advisor Department	Chemistry
SURF Field of Study	Computational Chemistry
Title of Abstract/Research	Spectroscopic and Computational studies of a Co(II)-substituted Small Molecule Mimic of Manganese Superoxide Dismutase: A Comparative Study

| **Please type your abstract below.** | Superoxide (O2•−)is a radical ion that at high concentrations can lead to oxidative stress, cause aging, inflammatory diseases, and cancer.Superoxide dismutases (SODs) are metalloenzymes that act on superoxide to produce H_2O_2 and O_2. SODs bind metals such as iron, manganese, copper, zinc, and nickel in their active sites. Small molecule mimics of SODs are studied because they are potential therapeutic agents. The best mimics to date are based on Mn(II) pentaazamacrocylic complexes. Our study focused on the effects of Co(II) substitution of a known Mn(II) complex [Mn(pyane))Cl2) , [where payne = (Me2[15]pyridinaneN5)(H2O)2). These were supplemented by density functional theory (DFT) and time-dependent (TD-DFT) calculations to obtain insight into the ground and excited electronic states of the complexes.

The Co(II)(payne)Cl2] was synthesized via the reaction of CoCl2, 3,6-Diazaoctane-1,8-diamine, and 2,6-diacetylpyridine under reflux. . The diamine ligand of the complex was reduced using sodium triacetoxyborohydride resulting in a color change from orange to yellow. We were unable to obtain crystals of the final complex, due to its instability over time. DFT, geometry optimizations, single point, and TD-DFT calculations were carried out on both Co(II)[payneCl2] and possible Co(II)[payne(H2O)2]complexes for two possible spin states of the metal (S=3/2 and S= ½). In conjunction with our electronic absorption spectroscopic data of both reduced and unreduced complexes, the computational studies indicate the final complex is described as a high spin S = 3/2 Co(II)[payneCl2] compound. The primary, low energy electronic transitions are best described as ligand payne to metal charge transfer transitions, with contributions from cobalt d → d transitions.

We further investigated a possible azide adduct (by replacing two chloride ligands with azides) using our established computational methodology. Azide is used as a mimic for superoxide because of their chemical similarities.

Comparison of the highest occupied molecular orbitals of the optimized Co(II)[payne(N3)2] and the Mn(II)[payne(N3)2] structures indicated that the former has higher orbital mixing and therefore faster electron transfer between the ligand and metal center. We suggest initial binding of superoxide to Co(II)[payneCl2] should be faster than with Mn(II)[payneCl2] .However, as subsequent turnover steps are yet to be studied the effect of this initial binding and electron transfer on overall turnover rates cannot be established. |

SURF 2018-Post SURF Survey

Name	Alexandria Perry
Year of Graduation	2018
Are you in a Graduate program?	yes
SURF Advisor	Julianna Tymoczko, Mathematics and Statistics
Advisor Department	Mathematics and Statistics
SURF Field of Study	Splines
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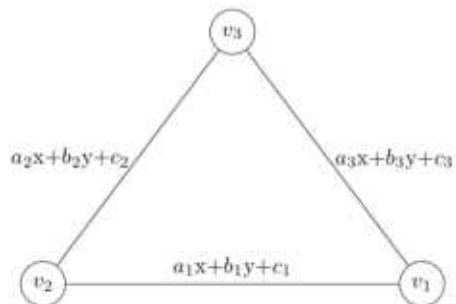
A Perry SURF Pic.png

Title of Abstract/Research	Dual Graphs and Polynomial Combinations

Please type your abstract below.

The following is a summary of both methods attempted and results achieved during the 2018 summer semester. It is necessary to summarize both productive and unproductive methods as context for this project's ongoing experimentation. This project was advised by Julianna Tymoczko. Fellow summer research students, Nicki Magill, Garcia Sun and Nancy Yun, also contributed.

Initially, we began the summer hoping to understand graph dualization as a means for converting between any triangulation and its dual graph n-cycle. As a result our first approach was to analyze and compare the dimensions of triangulations and their corresponding dual graphs. In doing so, we aimed to understand connections and disparities between results given by Peter Alfeld's Minimal Determining Set Program (MDS) and results obtained using Macaulay2 software and the "algebraicsplines" package's command "generalizedSplines."

We next worked on translating n-cycles into their corresponding triangulations. Generally, we begin by understanding each n-cycle graph as a n-polygon. Next we draw a vertex on the polygon's face and new edges through each original edge. These new edges will be the interior edges of the triangulation. To form the exterior edges of the triangulation, we draw a new edge in front of each vertex at which exactly two original edges intersect. The points at which the new edges intersect will be the exterior vertices. Lastly, we extend the new interior edges to the nearest intersection of exterior edges. As a result of understanding this process, we were able to prove the following propositions: 1.) Every triangulated hexagon has at least 3 distinct edge labels, 2.)No pinwheel graph has a dual graph with just one edge label, 3.) Every triangulated square has at least 2 distinct edge labels and finally, 4.) For n≥5, every triangulated n-polygon has a minimum set of distinct edge labels. The minimal number of edge labels is given by $(n/2)$ for the case when n is even and by $[(n-1)/2]+1$ when n is odd.

To further understand the analogy between n-cycles and their triangulations, we then examined bases generated for 3-cycles with polynomial edge labels, e_3, e_2, and e_1. We conjecture that there are 3 "types" of bases generated depending on the number of linearly independent edge labels and that any base generated will attempt to "surmount" linear independence with polynomial combinations rather than linear combinations.

SURF 2018-Post SURF Survey

Name	Julianna Alvord
Year of Graduation	2019
SURF Advisor	Randi Garcia, Psychology
Advisor Department	Statistical and Data Sciences
SURF Field of Study	Statistical and Data Sciences
Title of Abstract/Research	Developing an Application for Accesible use of Family Life, Activity, Sun, Health, and Eating (FLASHE) Survey Data
Please type your abstract below.	The purpose of this project was to create an application that allows users to format then download data from the Family Life, Activity, Sun, Health, and Eating (FLASHE) study. Creating tools such as this that increase accessibility to data sources is an important part of the growing field of data science. FLASHE is a National Institute of Health study from the Division of Cancer Control and Population Sciences. Parents/caregivers and his/her adolescent child were enrolled then randomly selected to take part in this study. The survey focuses on lifestyle behaviors to help researchers understand their effect on cancer risk. Due to the dyadic format, research using this data could require additional manipulations which exceed the capabilities of many. The app, built using the Shiny package in R, includes multiple features. First, users can perform basic exploratory data analyses of individual variables. In addition, they can choose their desired format and variables then download as a comma separated value (CSV) file. Finally, users can download an updated codebook to assist research projects. In the near future, the app will include even more features. Soon, users will be able to run Actor-Partner Interdependence Models (APIM), the statistical model of choice for dyadic analyses. The app will then give text output that could be used as a model for a results section. Each additional aspect of the app will allow for wider accessibility to and use of the important data gathered through the FLASHE study.

SURF 2018-Post SURF Survey

Name	Eleanor Donaher
Year of Graduation	2020
Are you in a Graduate program?	no
SURF Advisor	Ileana Streinu, Computer Science
Advisor Department	Computer Science
SURF Field of Study	Kinari/molecular modeling
Upload image(s) in .png format; 1,100 MB max size each	jmol.PNG
Title of Abstract/Research	Kinematics and Rigidity of Proteins in the Protein Data Bank
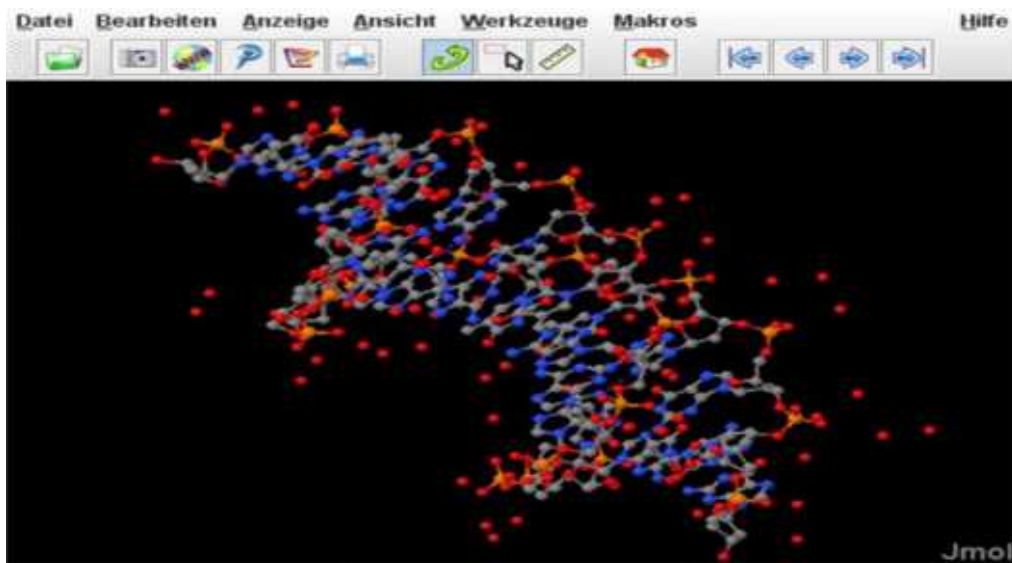
Please type your abstract below.

The Protein Data Bank (PDB) contains experimentally found information on the molecular makeup and properties of over 100,000 proteins/nucleic acid. The information contained in this data bank has previously been applied to finding the treatment for HIV, highlighting the importance of being able to interact with the information contained in the data bank.

The goal of our research was to create programs to allow a user to easily interact and manipulate the data contained in the Protein Data Bank in a 3D model. The site that we created (named Kinari for Kinematics And Rigidity) contains many smaller python scripts that interact to allow the user to screen the information – for example viewing specific models, protein chains, or removing ligands from the model. These manipulations are important to model in 3D as it shows how the individual atoms are oriented in space. Below is what the full molecule looks like when viewed using JMol, which Kinari utilizes to visualize the data.

SURF 2018-Post SURF Survey

Name	Erika Melara **Smith**
Year of Graduation	2020

Are you in a Graduate program?	no
SURF Advisor	Andrew Guswa, Engineering
Advisor Department	Engineering
SURF Field of Study	Ecohydrology Modeling

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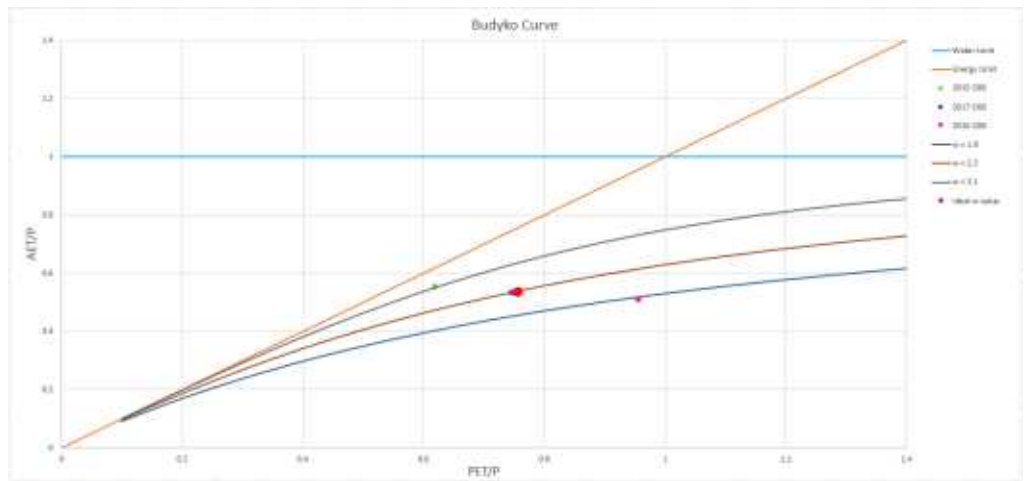
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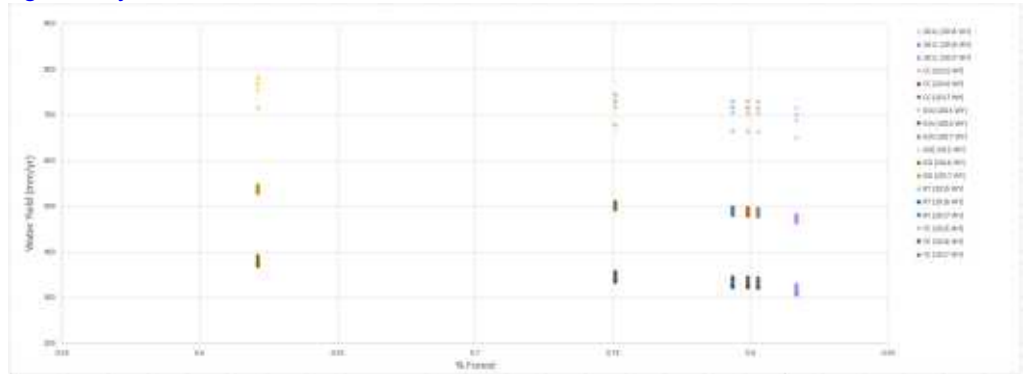
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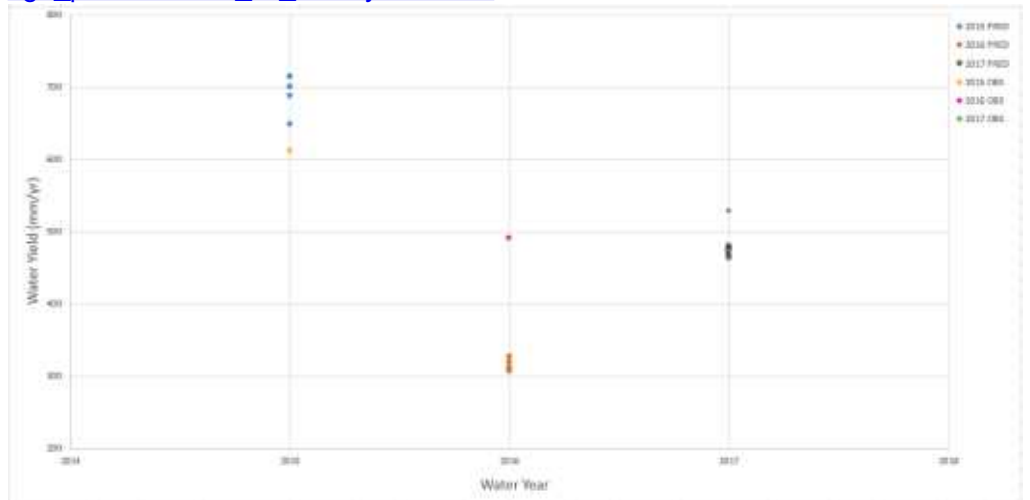
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Title of Abstract/Research

Assessing InVEST annual water yield model in Mill River Watershed

Please type your abstract below.

As the environment experiences changes in its landscape, science uses valid tools to measure these accurately and draw conclusions that contribute to a sustainable decision-making. The objective of this research was to implement the InVEST water yield model for the Mill River watershed and compare the values with quantities from the U.S. Geological Survey (USGS) from 2015 to 2017 (water year). Additionally, the model was used to explore the effects of future land use (year 2060) on water yield using six New England scenarios provided by Harvard Forest.

Model parameters were determined from different data sources, including the model user guide, research papers, and US national-scale datasets.

Precipitation data were obtained from five stations and were interpolated once using all stations and five more times, each time leaving out a different station. The model, which is based on the Budyko theory (Figure 1), was executed six times for each year.

The future scenarios with varying land use and forest percentages showed an increase in water yield for all years compared to the 2011 results (current land use). For each year, the water yield remained within the same range for all scenarios (Figure 2). For 2015, the model overestimated the observed water yield value by 6-17%; for 2016, the outputs were below the observed measurement by 33-37%; for 2017, the program underestimated the water yield by 9-12% (Figure 3). The results were relatively close to the actual water yield measurements but were not an accurate estimation. This discrepancy can be attributed to the selection of the input parameters or the simplicity of the model.

SURF 2018-Post SURF Survey

Name	Yacine Fall
Year of Graduation	2021

Are you in a Graduate program?	no
SURF Advisor	Sarah Moore, Engineering
Advisor Department	Engineering
SURF Field of Study	Biomedical engineering and Cancer Research
Please list co-authors of your abstract	Yanxuan Li
Title of Abstract/Research	Characterizing Engineered Proteins for Targeted Cancer Therapy

Please type your abstract below.

According to the American Cancer Society, in 2018, there will be an estimated 1,735,350 new cancer cases diagnosed in the United States. It is a disease that has been historically treated with invasive and toxic methods, however, scientists are investigating new cancer treatments that are more targeted through genes and proteins. Some cancers are harder to treat because they may lack not only successful therapies but effective diagnostics. Our lab aims to develop a protein that can serve as both a cancer targeting diagnostic and therapeutic by binding to a specific biomarker on cancer cells known as mesothelin (MSLN). The protein we engineered, called anti-MSLN 1.4.1, has been shown to be internalized by cancer cells exhibiting this biomarker once the protein binds MSLN. This summer, we continued to characterize this interaction and understand what happens to cancer cells once our protein binds. Specifically, we looked at whether apoptosis is activated.

There are many pathways that can cause cell death. Apoptosis means programmed cell death, and cancer therapies are often designed to cause apoptosis. We used an apoptosis assay to measure apoptotic cells and cells that died abruptly, known as necrotic cells. Necrotic cells exhibit loss of plasma member integrity, random degradation of DNA, and swelling of the nucleus. The propidium iodide (PI) in the apoptosis assay can stain the DNA to indicate necrosis. On the other hand, apoptotic cells have characteristics including activation of caspases, DNA fragmentation, and externalization of phosphatidylserine on the plasma membrane. We used Alexa Fluor 488 (green) labeled Annexin V that can combine with phosphatidylserine to allow the visualization of apoptosis. We incubated a protein treatment that should not cause cell death as a negative control and a cell-killing molecule mitomycin C (positive control) with human cervical cancer cells and stained cells with PI and Annexin V. Then the sample was analyzed by the flow cytometry. Our result shows that mitomycin C (mmc) is a good positive control and that the negative control caused less apoptosis than mmc. In future work, we will measure whether our engineered therapeutic can cause desired apoptosis.

To further compliment the apoptosis assays, we created experiments that tested whether or not the caspase cascade was activated. Caspases are essential to apoptosis because their activation breaks down cellular proteins. If caspases are active in the cancer cells, then cell death is happening through an activated apoptosis pathway. The Caspase Glo 3/7 assay uses a substrate that gets cleaved when caspases are active, and the product that forms is luminescent. We incubated the Caspase Glo 3/7 reagent with cancer cells treated with mitomycin C (positive control) or the negative control treatment. Our results illustrated that the positive control induced caspases and we determined the appropriate conditions for conducting the experiment. In future work, we will continue to evaluate the negative control treatment, and begin to measure whether our engineered protein can induce apoptosis.

53 **Name**	Ketty Munyenyembe
Year of Graduation	2020

Are you in a Graduate program?	no
SURF Advisor	Laura Katz, Biological Sciences
Advisor Department	Biological Sciences
SURF Field of Study	Biology
Title of Abstract/Research	Biodiversity of Testate Amoebae in New England Bogs and Fens
Please type your abstract below.	Testate amoebae are a group of unicellular eukaryotic microorganisms that build shells called tests. (Creevy et al. 2018). These organisms build shells using materials from their environments. Because of this, their shells can be calcareous, siliceous and proteinaceous (Mieczan 2008). These eukaryotes are very sensitive to environmental changes such as temperature, moisture and pH, as a result, they are useful models for paleoenvironmental studies and they are great bioindicators of environmental changes (Creevy et al. 2018). Testate amoebae communities can detect environmental changes that even sensitive instrumentation cannot (Swindles et al. 2016). Tracking these communities will therefore show the broader implications on biodiversity in a changing environment. Despite their ability to respond to environmental changes, testate amoebae are poorly studied. Some amoebae cells are morphologically identical but genetically distinct, and so their physical features alone cannot be used to determine the species, which results in cryptic diversity (Lahr et al. 2014). Cryptic species are defined as are organisms that look the same but are genetically different (Lahr et al. 2014). It is this understanding of cryptic diversity that drove our work to identify cryptic species within these communities. This summer our research focused on sampling sphagnum moss from New England bogs and fens in order to analyze the communities using both morphologic and genetic analyses. We traveled to Harvard Forest in Petersham MA, and Hawley Bog in Hawley, MA in order to collect the moss samples. From our moss samples, we created plates that we used to count and pick amoebae cells. We collected morphological data by counting amoebae on these plates for twenty minutes. For the molecular work, we picked single cells from our plate samples and made copies of the whole genome using Whole Genome Amplification (WGA). We cleaned and quantified the DNA from each cell and did Polymerase Chain Reactions (PCR) using Arcellinida specific primers designed in the Katz Lab. We

then sequenced our PCR products using the Sanger sequencing method and the resulting products were sequenced at Smith's Center for Molecular Biology. We were able to analyze our results using software called Seqman Pro and BLAST. Our sequences were successful and we identified two species Hyalosphenia papilio and Nebela tubulosa.

Continuing our research, we will send samples of community DNA and RNA out for high throughput sequencing, and analyze our morphological data counts so we can compare what species of amoebae we are seeing to what species of amoebae are really there based on genetics.

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Daniel J. G. Lahr, Haywood Dail Laughinghouse IV, Angela M. Olivia, Feng Gao and Laura Katz. 2014. How discordant morphological and molecular evolution among microorganisms can revise our notions of biodiversity on Earth. 1-3.

Swindles, Graeme T, et al. "Evaluating the Use of Dominant Microbial Consumers (Testate Amoebae) as Indicators of Blanket Peatland Restoration." Egyptian Journal of Medical Human Genetics, Elsevier, 20 May 2016, www.sciencedirect.com/science/article/pii/S1470160X16302138.

SURF 2018-Post SURF Survey

Name	Aoi Ogawa
Year of Graduation	2020

Are you in a Graduate program?	no
SURF Advisor	Jan Vriezen, Biological Sciences
Advisor Department	Biological Sciences
SURF Field of Study	biological sciences
Please list co-authors of your abstract	Taylor McCain
Title of Abstract/Research	Discovery of Novel Antibiotics Produced by Bacteria from Soil Isolates

Please type your abstract below.

This summer we tested interactions (a positive interaction is the presence of a zone of inhibition) between bacteria from forest subsurface (FSS) and grassland surface (GS) soil samples collected at the McLeish Field Station. The goal of our summer was to estimate the number of positive interactions for the FSS and GS bacterial populations and use the data in models and cellular automate in the future. We tested for positive interactions between the 25 isolates from the FSS group and 53 isolates from the GS group. For both populations the experiments were executed three times. If an isolate was 2 or 3 times positive on a certain indicator lawn, the summary score would be positive and visa versa. This resulted in an FSS interaction matrix of 25x25 and a GS interaction matrix of 53x53, of which 26.4 % and 37.5 % were positive for FSS and GS respectively. (P=0.02, Heteroskedastic, one sided Ttest). This observation supports the idea that antibiotic production is mediated by competition and is more important in environments with a higher bacteria load (CFU GS> CFU FSS). Furthermore, the expected number of gram-positive isolates inhibiting gram-negative isolates is highly underrepresented ($0.01 > p > 0.001$ and $p < 0.001$ for FSS and GS respectively, using Chi2), indicating that cell-type, gram-positive (presence of a cell wall) and gram-negative (lack of a cell wall), substantially affect the outcome of competition. We hypothesize that the inability of gram-positive bacteria to inhibit the growth of gram-negative bacteria could be due to a secondary metabolite that targets the cell wall, which is ineffective against gram-negative bacteria. Among both the FSS and GS populations, we found the most positive interactions (isolate producing an antibiotic that inhibits the growth of the lawn) when placing gram-positive producers on a gram-negative lawns. In order to visualize our data we employed CytoscapeTM (3.6.1) which enabled us to map out all of the interactions between each of the bacterial genera. Interestingly, despite different populations, the interactions between the GS and FSS had very similar topography with the following differences: there were more interactions between gram-negative lawns and gram-negative producers in FSS, and more interactions between gram-positive lawns and gram-positive producers in GS.

SURF 2018-Post SURF Survey

Name	Olivia Dufour **Smith**
Year of Graduation	2020
Are you in a Graduate program?	no
SURF Advisor	Laura Katz, Biological Sciences
Advisor Department	Biological Sciences
SURF Field of Study	Biology
Please list co-authors of your abstract	Ketty Munyenyembe
Title of Abstract/Research	Biodiversity of Testate Amoebae in New England Bogs and Fens

Please type your abstract below.

Testate amoebae are a group of unicellular eukaryotic microorganisms that build shells called tests (Creevy et al. 2018). These organisms build shells using materials from their environments. Because of this, their shells can be calcareous, siliceous and proteinaceous (Mieczan 2008). These eukaryotic cells are very sensitive to environmental changes such as temperature, moisture and pH; as a result they are very useful models for paleoenvironmental studies and are great bioindicators of environmental changes (Creevy et al. 2018). Testate amoebae communities can detect environmental changes that even sensitive instrumentation cannot (Swindles et al. 2016). Therefore, tracking these communities can show the broader implications on biodiversity in a changing environment.

This summer our research focused on sampling sphagnum moss from New England bogs and fens in order to analyze testate amoebae communities using morphologic and genetic analyses. We collected samples from Harvard Forest in Petersham MA, and Hawley Bog in Hawley, MA. From our moss samples we created plates and used them for microscopy work. We collected morphological data by counting amoebae individual cells for twenty minutes per plate.

We picked single cells from plate samples and made copies of the genome using Whole Genome Amplification (WGA). We cleaned and quantified the DNA of each cell and did Polymerase Chain Reactions (PCR) using Arcellinida specific primers designed in the Katz Lab. We then sequenced our PCR products using Sanger sequencing method at Smith's Center for Molecular Biology. Finally we analyzed our results using Seqman Pro software and BLAST. Our successful sequences were identified as two species, Hyalosphenia papilio and Nebela tubulosa.

Continuing our research, we will send samples of community DNA and RNA out for High Throughput Sequencing, and analyze our morphological data counts so we can see what species of amoebae we are seeing under the microscope to what species of amoebae are really there based on the DNA and RNA we extracted.

References:
Creevy AL, Andersen R, Rowson JG, Payne RJ. 2018. Testate amoebae as functionally significant bioindicators in forest-to-bog restoration. Ecological Indicators 84:274–282 .

Mieczan T. 2008. Ecology of testate amoebae (Protists) in Sphagnum peatlands of eastern Poland: Vertical micro-distribution and species assemblages in relation to environmental parameters.

Swindles, Graeme T, et al. "Evaluating the Use of Dominant Microbial Consumers (Testate Amoebae) as Indicators of Blanket Peatland Restoration." Egyptian Journal of Medical Human Genetics, Elsevier, 20 May 2016, www.sciencedirect.com/science/article/pii/S1470160X16302138.

SURF 2018-Post SURF Survey

Name	Adena Collens
Year of Graduation	2021

Are you in a Graduate program?	no
SURF Advisor	Laura Katz, Biological Sciences
Advisor Department	Biological Sciences
SURF Field of Study	Testate Amoebae in New England Bogs and Fens
Title of Abstract/Research	Identifying Testate Amoeba with Morphological and Molecular Methods

Please type your abstract below.

Amoeba are single-celled eukaryotes which have protrusions in their cytoplasm called pseudopodia which they use to move and capture prey. This summer, I familiarized myself with testate, or shell-building, amoeba. Testate amoeba are important for their geologic and environmental significance. They are microbial apex predators in bogs and fens, so studying their diversity and abundance allows for greater understanding of the impact of climate change in these fragile ecosystems (Jassey et. al, 2013). Additionally, because testates build their shells with materials from their surrounding environment, geologists use testate fossils to understand the re-establishment of communities throughout geologic time and events (Maxence Delaine et. al, 2016).

Testates build many different kinds of shells. Some shells are smooth, and others have ridges, scales, or spines. This summer, I used a light microscope to observe communities Agnes Weiner's samples from Hawley Bog and Acadia National Park and my samples from bromeliads and pitcher plants in Lyman Plant House. From these observations, I learned the differences in these shell characteristics, known as morphology, to identify which group and species different testate amoeba belong to. Below are two images I captured with a light microscope of a Heleopera spp. (left) and a Hyalosphenia papilio (right) which were both found in the Hawley Bog samples.

In addition to identifying testates by morphology, I also learned how to use molecular methods to identify cells. I familiarized myself with the various steps needed to sequence a genome, and made a diagram organizing the protocol for each step to help new lab members in the future. Unfortunately, my first and second attempts at DNA sequencing failed, so I was unable to analyze my data before leaving the lab.

From my work this summer, I now have gained familiarity and experience with the procedures necessary to prepare DNA for sequencing. In the fall, I look forward to learning how to analyze my sequences and continuing to explore the significance of testate amoeba in bogs, fens, and other habitats.

Jassey, V. E., Chiapusio, G. , Binet, P. , Buttler, A. , Laggoun-Défarge, F. , Delarue, F. , Bernard, N. , Mitchell, E. A., Toussaint, M. , Francez, A. and Gilbert, D. (2013), Above- and belowground linkages in Sphagnum peatland: climate warming affects plant-microbial interactions. Glob Change Biol, 19: 811-823. doi:10.1111/gcb.12075

Maxence Delaine, Leonardo D. Fernández, Eric Armynot du Châtelet, Philippe Recourt, Jean-Luc Potdevin, Edward A.D. Mitchell, Nadine Bernard, Cinderella's helping pigeons of the microbial world: The potential of testate amoebae for identifying cryptotephra, European Journal of Protistology, Volume 55, Part B, 2016, Pages 152-164, ISSN 0932-4739, https://doi.org/10.1016/j.ejop.2016.05.003.

SURF 2018-Post SURF Survey

Name	Gariel Grant **Smith**
Year of Graduation	2019

Are you in a Graduate program?	yes
SURF Advisor	Adam Hall, Biological Sciences
Advisor Department	Biological Sciences
SURF Field of Study	Biological Sciences
Upload image(s) in .png format; 1,100 MB max size each	
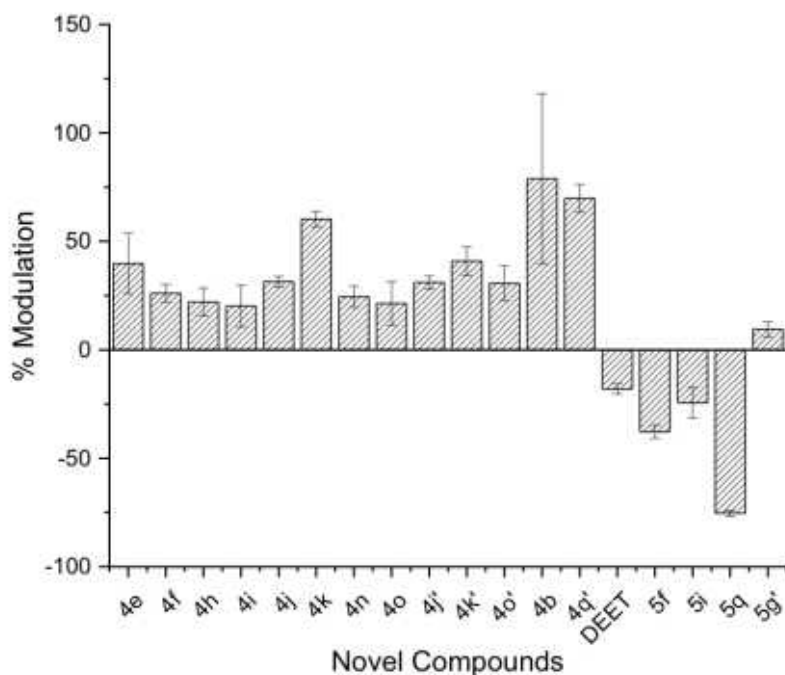
Figure 1. Carboxamides are generally negative modulators of glycine receptors, while acylpiperidines are positive modulators of the receptors. Relative modulations of EC_{10} glycine responses (30 μM) were compared by co-applying 300 μM of the novel repellents (or DEET). The graph summarizes the percentage modulation of all the tested repellents, highlighting the distinct effects of the two classes of chemicals ($n \geq 5$)

GGrant.png

Title of Abstract/Research	Can your insect repellent do you more harm than good? The Interactions of N, N- diethyl-meta-toluamide (DEET) and Novel Acylpiperidines and Carboxamides with Human GABAA and Glycine Receptors
Please type your abstract below.	Mosquito-borne diseases such as malaria, dengue and yellow fever are responsible for several million deaths annually. Repellents disrupt interactions between humans and insects, thus providing personal protection from the bites through which the diseases are transmitted. The most commonly used repellent today is N, N- diethyl-meta-toluamide, DEET. Despite its popularity, DEET is not effective against all species of mosquitoes, and there are widespread concerns about its possible toxicity to users. Consequently, the USDA has undertaken the task of discovering new repellents which are safer, effective for longer durations, and more efficacious against a broader range of arthropods. These novel repellents fall under two classes of chemicals: acylpiperidines and carboxamides.

The present electrophysiological study investigates the neurotoxicity of these novel repellents relative to that of DEET, focusing on the effects of the repellents on the two major inhibitory receptors of the nervous system: GABA and glycine receptors. The activity of the receptors can be positively modulated (enhanced) or negatively modulated (inhibited) by a wide range of drugs and chemicals. Chemicals that enhance the activity of the receptors are often used as therapeutic agents in the treatment of anxiety, epilepsy, and as general anesthesia to render a patient unconscious during invasive procedures. Conversely, chemicals that inhibit the activity of the receptors generally produce stimulant effects, and can lead to the onset of seizures. In this study, the two-electrode voltage clamp technique was utilized, in which Xenopus laevis oocytes provide an isolated environment for modeling the chemical modulation of the receptors. Oocytes were injected with RNA encoding human GABAA and glycine receptors, voltage-clamped and exposed to the repellents via superfusion. Results indicate that high concentrations of DEET negatively modulate glycine receptors, inhibiting currents up to 94% at the highest tested concentration (30mM DEET). Interestingly, most carboxamides (including DEET) inhibited the activity of glycine receptors, while acylpiperidines enhanced the activity of glycine receptors (Figure 1). Neither acylpiperidines nor carboxamides were found to inhibit the activity of GABA receptors, with DEET and other carboxamides acting as weak agonists at high concentrations (>1mM) to produce maximal GABA currents. The data suggest that DEET and the novel repellents have distinct effects on GABAA and glycine receptors. Furthermore, the results indicate a stark difference between the 2 classes of chemicals, where acylpiperidines may infer less relative toxicity than carboxamides, which act like strychnine (a convulsant commonly used to kill small rodents and birds) on glycine receptors. |

SURF 2018-Post SURF Survey

Name	Chris Tan
Year of Graduation	2021

Are you in a Graduate program?	no
SURF Advisor	R.Jordan Crouser, Statistical and Data Sciences
Advisor Department	Computer Science
SURF Field of Study	Computer Science and Data Science
Please list co-authors of your abstract	Sherry Zhenyao Cai, Stella Chen Li, Hening Zheng, Starry Yujia Zhou

Upload image(s) in .png format; 1,100 MB max size each

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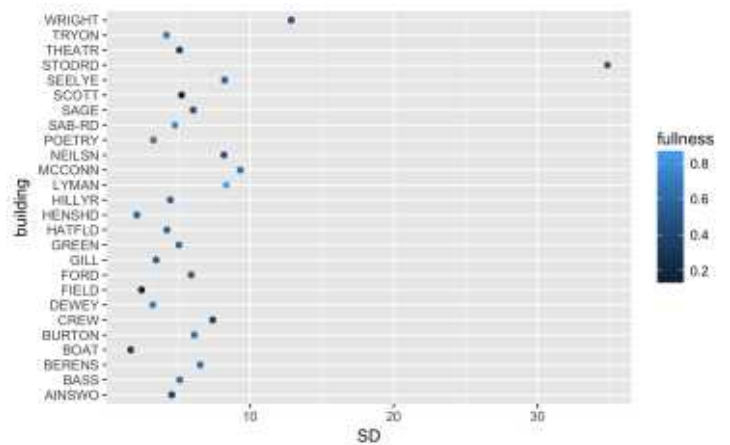
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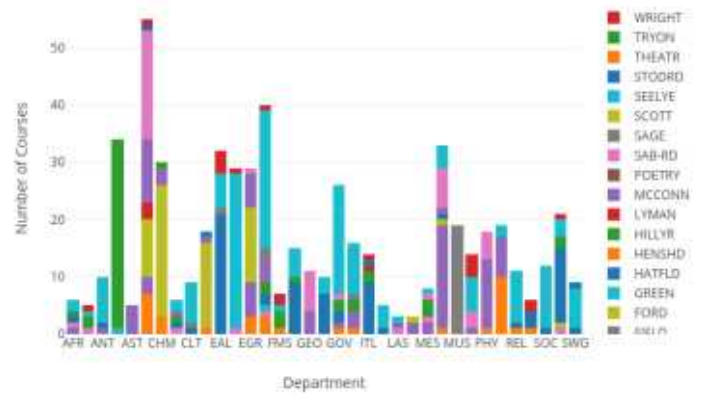
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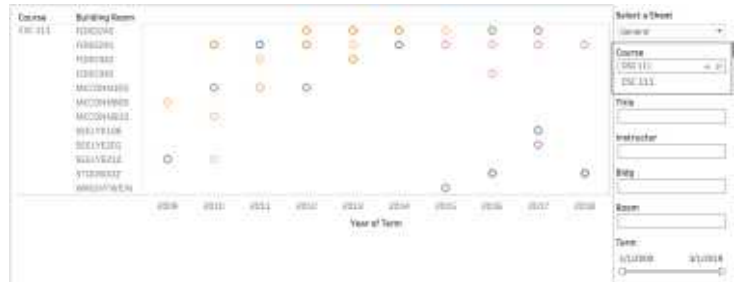
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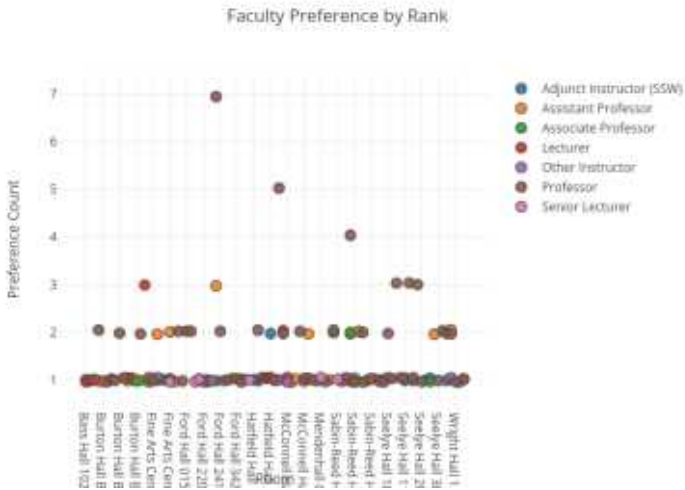
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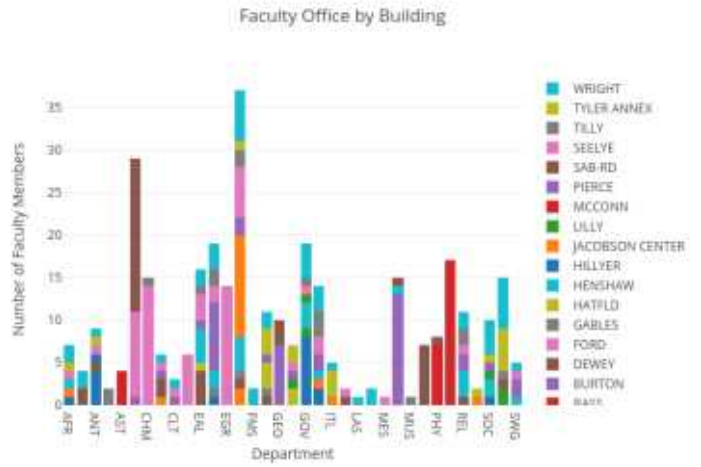
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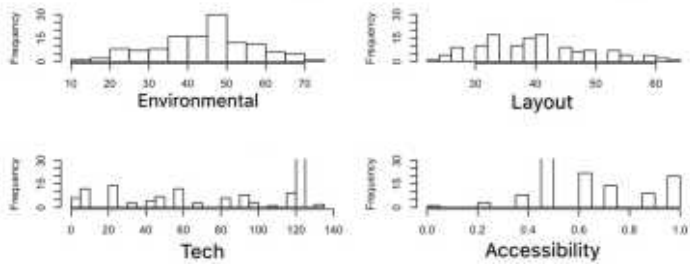
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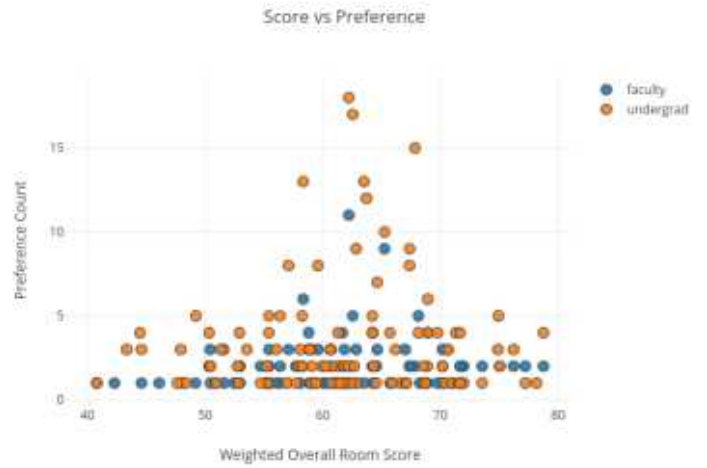
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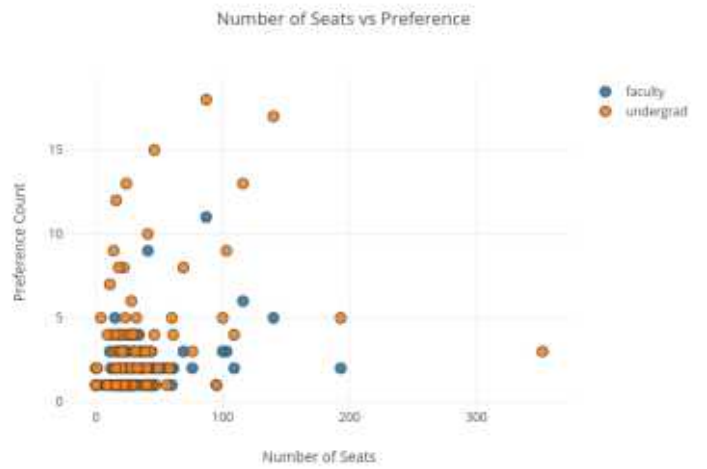
Chris_Tan_seats-vs-preference.png

Title of Abstract/Research   Smith College Learning Space Assessment

Please type your abstract below.

In 2017-2018, Smith College contracted Sasaki Associates, Inc. to conduct a survey of Smith College study space analysis. During the summer of 2018, five undergraduate student researchers in the Human Computation and Visualization Laboratory conducted additional analysis of the collected data under the supervision of Prof. R. Jordan Crouser.

This reanalysis of Smith Space Usage focused on evaluating utilization rates, technology deployment, campus geography and the physical condition of classroom spaces. The goal of this study is to identify potential methods to support faculty with their diverse pedagogy and enhance student learning experiences. The assessment was summarized as the convergence of the following two themes: Teaching, and Allocating. There are several essential goals we achieved at the end of this summer: (1) analyzed the correlation between Sasaki's scoring system and our own scoring system (HCV score); 2) examined the relevance of Sasaki' scores and faculties and students' preferences for classrooms to valid the reliability of Sasaki's scoring system; (3) studied other features that might faculties and students' preferences, which includes "number of seats" and "faculty member's academic rank "; (4) analyzed general usage of classrooms, whose topics include frequency of classrooms being used, average fullness and usage standard deviation and chair usage efficiency; (5) Develop a decision-making interface to help resource allocation and room assignment; (6) wrote a white book "Smith College Learning Space Assessment Report" to document and explain our research on Smith College space usage.

In the future study of this dataset, we would like to advance the research on the following aspects:

We would like to further our study on how the distance of a classroom to one's workspace or dorm room influences their preferences of it. We speculate that distance is an important aspect of the accessibility of study spaces for students. However, because the survey on faculties' and students' classroom preferences are all anonymous, we cannot conduct further analysis based on this data. Therefore, we would like to suggest Smith College Office of Institutional Research adds questions that address people's locations in the next survey.

To accelerate the process of the classroom assignment, we would like to include schedule into consideration. We would like to utilize To have each class associated with its time block, we could advance the current web interface to work on the scheduling much clearer and more efficient to come up with a more comprehensive schedule.

SURF 2018-Post SURF Survey

6 **Name**	Julia Falkner **Smith**
Year of Graduation	2019

Are you in a Graduate program?	no
SURF Advisor	Jill de Villiers, Psychology
Advisor Department	Psychology
SURF Field of Study	Psychology
Title of Abstract/Research	Maternal Mind Mindedness

Please type your abstract below.

Between the ages of 3-5, children undergo monumental growth in their "theory of mind" (TOM). Before this development occurs, most toddlers are unable to accurately assess what a parent, teacher, or other child knows, desires, intends, believes, or will behave under a given set of circumstances. After rapid development in TOM, aided by rapid language acquisition, they have acquired the necessary skills to think about other minds. I first became interested in TOM development, and its connections with language, during Professor Jill de Villiers' Psycholinguistics seminar at Smith last Fall.

In 2006-2007 a group of experts in child development, Professor de Villiers among them, experimentally evaluated Pre-K curricula by testing the students' cognitive progress, including their developing TOM. Children were scored on their Understanding of Desires and Understanding of Emotions based on Situations and Desires; as well as their ability to report who Sees something, who Knows something, and report the True Beliefs and False Beliefs of others in given narrative scenarios.

Ass part of my SURF, I investigated whether patterns in these students' TOM data could be predicted by the degree of "mind mindedness" in their mothers. In her 2001 paper "Rethinking maternal sensitivity", psychologist Elizabeth Meins described "maternal mind mindedness" (MMM) as "the mother"s proclivity to treat her infant as an individual with a mind, rather than merely as a creature with needs that must be satisfied." As a measure of their MMM, each mother of a child in the study was asked to describe their child for several minutes on a video recording. I coded each utterance from a sample of 40 mothers' transcripts into seven nonexclusive categories: cognitive, desire/preference, emotion, intention, behavioral, physical, and general. Based on a later paper written by Meins (2002), we predict that a higher degree of MMM in the mothers of the pre-K students would increase the students' TOM ability and growth during the years of the curricular intervention.

The MMM coding and data analysis is still in progress and will resume when I return from abroad this spring. Preliminary findings suggest a possible relationship between the density of the mothers' statements about desires and their children's performance on a test of Understanding of Desires.

Meins, E., Fernyhough, C., Fradley, E., & Tuckey, M. (2001). Rethinking maternal sensitivity: Mothers" comments on infants" mental processes predict security attachment at 12 months. Journal of Child Psychology and Psychiatry, 42, 637-648.

Meins, E., Fernyhough, C., Wainwright, R., Das Gupta, M., Fradley, E., & Tuckey, M. (2002). Maternal mind-mindedness and attachment security as predictors of theory of mind understanding. Child Development, 73, 1715-1726.

SURF 2018-Post SURF Survey

Name	Jane Kirby
Year of Graduation	2020

Are you in a Graduate program?	no
SURF Advisor	Christine White-Ziegler, Biological Sciences
Advisor Department	Biological Sciences
SURF Field of Study	Biological Sciences

Upload image(s) in .png format; 1,100 MB max size each

LB 23° 48+134 OD vs. Time

0.047
0.046
0.045
0.044
0.043
0.042
0.041
0.04
0.039
0.038
0.037
0.036

1   2   3   4   5   6

— Average OD600 48 LB 23   — Average OD600 134 LB 23

LB 37° 48+134 OD vs. Time

0.6
0.5
0.4
0.3
0.2
0.1
0

1   2   3   4   5   6

— Average OD600 48 LB 37   — Average OD600 134 LB 37

jkirby graph 1.png

M9 23° 48+134 OD vs. Time

0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0

1   4   7   10

— Average OD600 48 M9 23   — Average OD600 134 M9 23

M9 37° 48+134 OD vs. Time

1.2
1
0.8
0.6
0.4
0.2
0

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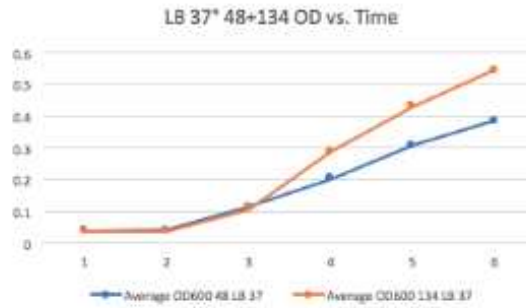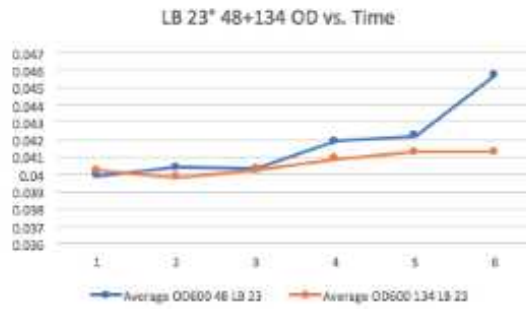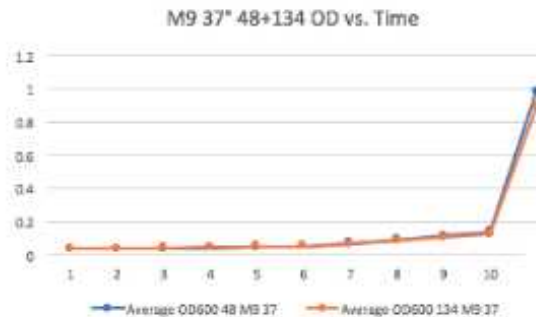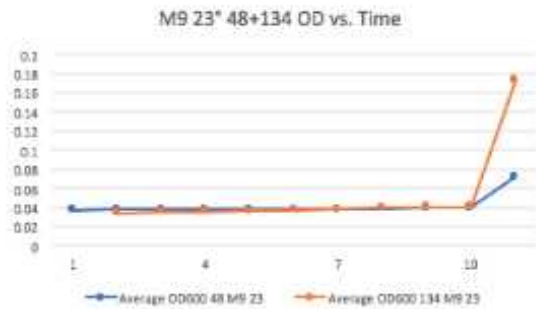
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Title of Abstract/Research

The role of temperature and nutrient availability in Escherichia coli antibiotic resistance

Please type your abstract below.

In modern biology, pathogenic bacteria displaying antibiotic resistance has become a pressing issue. Within this context of growing need, the White-Ziegler lab has been investigating cellular features that can be targeted to help clear an E. coli infection. Previous studies in the lab have demonstrated that approximately 10% of all E. coli genes are temperature regulated (White-Ziegler, 1998). As upshifted temperature is an environmental cue to pathogenic E. coli that they have entered a host, genes controlling surface proteases are upregulated to defend against AMP's of the host immune system (Thomassin, 2012). The aim of my research project was to examine the impact of antibiotics and bactericidal peptides on numerous strains of E. coli under varying temperatures and nutrient availability.

These relations were examined by using Minimum Inhibitory Concentration (MIC) assays because they indicate the concentration of antibiotic needed to inhibit bacterial growth as well as the organism's resistance to that drug. Growth inhibition is measured by a spectrophotometer and an optical density of ~0.5 is optimal for the growth control column.

Before introducing antimicrobial agents, incubation time values for four E. coli strains frequently used by the lab had to be determined under 23 versus 37°C and in LB and M9 growth medium to see when they all reached an OD600=0.5 for valid comparison. To obtain these values the CWZ lab's AMP assay protocol was implemented without antibiotics to create 96 well plates for the four strains used (K12 MC4100, 134; UPEC 523, 567) under described varying growth conditions. Plates were constructed with 5 growth control columns and one sterility control column according to which conditions would be tested and hourly optical density reads were taken.

Hourly reads between t=1 and t=10 and an additional read at t=24 were recorded during the first round of experimentation and showed that by 10 hours of incubation optimal growth had not been reached but upon and after 24 hours the plates had become overgrown. In the next phase of the project multiple plates under the same conditions were created at progressing time points over six days to obtain growth data between the first hour of incubation to 60 hours. This staggered plate making schedule was performed once and improved aspects of the project design were found that will be implemented in future research.

SURF 2018-Post SURF Survey

Name	Tijana Cooley **Smith**
Year of Graduation	2020

Are you in a Graduate program?	no
SURF Advisor	Niveen Ismail, Engineering
Advisor Department	Engineering
SURF Field of Study	Using Natural Systems to Improve Water Quality
Please list co-authors of your abstract	Ojaswi Aryal

Upload image(s) in .png format; 1,100 MB max size each

oaryal17.png

Title of Abstract/Research — Use of Fungi for Removal of Escherichia coli

Please type your abstract below.

The degradation of clean freshwater sources due to microbial pollutants has adverse effects on humans and environmental systems. New approaches for effective removal of these pollutants are needed to address this growing issue. The United States Environmental Protection Agency (USEPA) lists fecal indicator bacteria (FIB) as the leading cause of the impairment of water bodies[1], and an example of such an FIB is Escherichia coli found in freshwater. Some studies have suggested that the use of fungi may be effective in removing E. Coli from water through the process of mycofiltration[2]. Our research investigated the interaction between E. coli and the fungi Pleurotus Ostreatus (oyster mushrooms). We also explored different procedures and experimental setups to test the feasibility of using fungi to remove E. coli.

We investigated the ability of fungi to remove E.coli with two systems; batch and flow through. We conducted batch experiments by placing bottles containing fungi and E. coli spiked water on a shaker for the duration of the experiment, varying the amount of fungi in contact with the water. Flow-through experiments consisting of multiple recirculations of E. coli spiked water through sieves of packed fungi were set up as shown in Figure 1. While the results from batch procedure did not show significant removal of E.coli, the flow-through experimentation generated data showing approximately 1 log removal. The results suggest that a fungi system may be effective in E. coli removal and that the interaction of fungi and water of the flow-through system is more effective that a batch system. Future research includes developing a more rigorous and reliable flow-through design and testing different parameters to ultimately create a bioretention system able to treat runoff.

Figure 1: Sieves C, B and D from left to right packed with fungi and sawdust, B was pre-soaked.

1. U.S. EPA. Recreational Water Quality Criteria. Rep. no. EPA-820-R-14-011. U.S. Environmental Protection Agency - Office of Water, 2012. Web.
2. Taylor, Alex, et al. "Removal of Escherichia coli from synthetic stormwater using mycofiltration." Ecological engineering 78 (2015): 79-86.

SURF 2018-Post SURF Survey

Name	Yanxuan Li
Year of Graduation	2020

Are you in a Graduate program?	no
SURF Advisor	Sarah Moore, Engineering
Advisor Department	Engineering
SURF Field of Study	Biomedical engineering
Please list co-authors of your abstract	Yacine Fall
Title of Abstract/Research	Characterizing engineered proteins for targeted cancer therapy

Please type your abstract below.

According to the American Cancer Society, in 2018, there will be an estimated 1,735,350 new cancer cases diagnosed in the United States. It is a disease that has been historically treated with invasive and toxic methods, however, scientists are investigating new cancer treatments that are more targeted through genes and proteins. Some cancers are harder to treat because they may lack not only successful therapies but effective diagnostics. Our lab aims to develop a protein that can serve as both a cancer targeting diagnostic and therapeutic by binding to a specific biomarker on cancer cells known as mesothelin (MSLN). The protein we engineered, called anti-MSLN 1.4.1, has been shown to be internalized by cancer cells exhibiting this biomarker once the protein binds MSLN. This summer, we continued to characterize this interaction and understand what happens to cancer cells once our protein binds. Specifically, we looked at whether apoptosis is activated.

There are many pathways that can cause cell death. Apoptosis means programmed cell death, and cancer therapies are often designed to cause apoptosis. We used an apoptosis assay to measure apoptotic cells and cells that died abruptly, known as necrotic cells. Necrotic cells exhibit loss of plasma member integrity, random degradation of DNA, and swelling of the nucleus. The propidium iodide (PI) in the apoptosis assay can stain the DNA to indicate necrosis. On the other hand, apoptotic cells have characteristics including activation of caspases, DNA fragmentation, and externalization of phosphatidylserine on the plasma membrane. We used Alexa Fluor 488 (green) labeled Annexin V that can combine with phosphatidylserine to allow the visualization of apoptosis. We incubated a protein treatment that should not cause cell death as a negative control and a cell killing molecule mitomycin C (positive control) with human cervical cancer cells and stained cells with PI and Annexin V. Then the sample were analyzed by the flow cytometry. Our result shows that mitomycin C (mmc) is a good positive control and that the negative control caused less apoptosis than mmc. In future work, we will measure whether our engineered therapeutic can cause desired apoptosis.

To further compliment the apoptosis assays, we created experiments that tested whether or not the caspase cascade was activated. Caspases are essential to apoptosis because their activation breaks down cellular proteins. If caspases are active in the cancer cells, then cell death is happening through an activated apoptosis pathway. The Caspase Glo 3/7 assay uses a substrate that gets cleaved when caspases are active, and the product that forms is luminescent. We incubated the Caspase Glo 3/7 reagent with cancer cells treated with mitomycin C (positive control) or the negative control treatment. Our results illustrated that the positive control does induced caspases and we determined the appropriate conditions for conducting the experiment. In future work, we will continue to evaluate the negative control treatment, and begin to measure whether our engineered protein can induce apoptosis.

SURF 2018-Post SURF Survey

Name	Dana Vera
Year of Graduation	2019
Are you in a Graduate program?	no
SURF Advisor	L.David Smith, Biological Sciences
Advisor Department	Biological Sciences
SURF Field of Study	Marine Science and Education
Please list co-authors of your abstract	Emiline Koopman '18J, Liz Nagy '18, Aidan Coffin Ness '20, Katherine Akey '20, Carla Schwartz '20
Title of Abstract/Research	Coral Reef Ed-Ventures Summer 2018

Please type your abstract below.

Summer 2018 was the nineteenth year of the Smith College collaboration with Hol Chan Marine Reserve on Ambergris Caye, Belize to create an environmental education and conservation experience for the children of San Pedro. Six Smith students developed the theme of "Making Connections" in the two free camps they designed for children on the island, incorporating methods they practiced during a week of research on the island with Smith College professors prior to the camps. The research focused on coral mounds at Mexico Rocks and mangroves propagules located in lagoons near the Grand Belizean Estates development.

Smith students conducted two research projects with professors David Smith, Denise Lello and Allen Curran. The first project was part of a long term survey of the health of coral mounds inside the barrier reef at a site called Mexico Rocks that was recently accorded protection as part of the Hol Chan Marine Reserve. These long term surveys at Mexico Rocks are meant to assess the amount of live coral cover and soft coral abundance and diversity, and track significant changes over time. Previously, several mounds towards the center of Mexico Rocks and several towards the south end had been sampled. These were resampled this year along with several mounds at the north end of the area. The second project tracked mangrove survival in the mangrove lagoons in the interior of the island in the vicinity of fill associated with development. Previous research has indicated that several biotic and abiotic factors can impact the persistence of mangrove. Students mapped all propagules within plots and collected data for each propagule mapped using underwater images of organisms associated with the propagules and visual assessment of damage and herbivory.

This year's theme for youth camp, the first summer camp that the Smith students hosted, was "Making Connections". The Smith students created activities focused on five topics: human impact, plastics, mangroves, fossil fuels, and marine protected areas (MPAs). For example, the campers were presented with information about how macro and micro-plastics affect the entire food chain, starting with bottom of the food chain and moving up to large fish which humans may eventually consume. Interactive activities (e.g., a beach clean up, an edible coral polyp activity) were paired with short lectures and videos. This versatility allowed campers to make connections between the ocean ecosystems and inhabitants and land-based human activities, and gain more perspective and awareness about how they can best protect our oceans.

Children 12 and up, or those who had previously participated in the Youth Camp, attended an upper level R.E.E.F (Research in Ecology and the Environment is Fun) Program. This year's theme for the R.E.E.F. program was "Mapping". Campers were introduced to various spatial research methods, including how to calculate percent live coral cover on coral mounds. Environmental consultants, who were performing assessments prior to development of the the neighboring island of Blackadore Caye, came to camp, discussed techniques for mapping the seafloor around Ambergris Caye, and showed campers the advanced equipment they use. Campers also collected and mapped the plastics they found on the beach in front of the high school, using GPS and data collection software the Smith students had used in the mangrove research. Campers took two field trips, one to the mangroves and one to the lagoon side of the island. During the field trip to the mangroves, children learned about the importance of the mangroves and how crocodiles are rehabilitated and released in the area. With a greater understanding of how research is conducted, campers were able to make meaningful connections between the ecosystems that link the ocean and their home on the island of Ambergris Caye.

In summary, our research advanced understanding of changes in coral and mangrove habitats and the education program exposed children on the island to specific environmental changes that are impacting their everyday life (e.g., plastics). This summer of Coral Reef Ed-Ventures was full of new experiences and learning opportunities that we hope to expand upon in coming years.

SURF 2018-Post SURF Survey

Name	Taylor McCain
Year of Graduation	2020
Are you in a Graduate program?	no
SURF Advisor	Jan Vriezen, Biological Sciences
Advisor Department	Biological Sciences
SURF Field of Study	Biological Sciences
Please list co-authors of your abstract	Aoi Ogawa
Upload image(s) in .png format; 1,100 MB max size each	
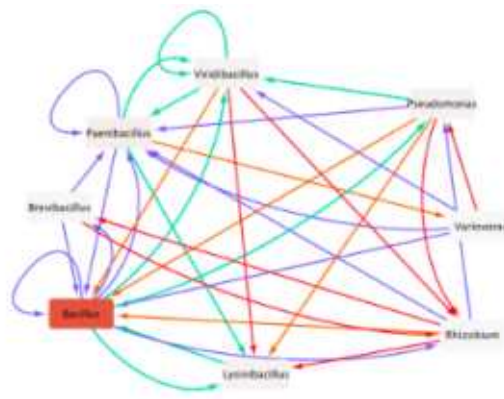
Fig.1: Interaction mapping GS isolates
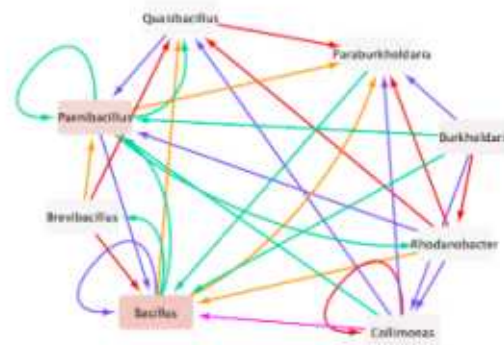
Fig. 1 and Fig. 2: FSS Mapping

The color of the lines indicates varying interaction rates. The green lines indicate an interaction rate between 0% to 25%, the blue lines indicate 25% to 50%, the orange lines indicate 50% to 75%, the pink lines indicate 75% to 99% and the red lines indicate 100%. The color of the genus names indicate the number of isolates were each genus. The color of the genus names range from gray (few isolates in that specific genus) to red (many isolates in that specific genus).

Screen Shot 2018-09-06 at 4.11.44 PM.png

Title of Abstract/Research	Discovery of Novel Antibiotics Produced by Bacteria from Soil Isolates

Please type your abstract below.

This summer we tested interactions (a positive interaction is the presence of a zone of inhibition) between bacteria from forest subsurface (FSS) and grassland surface (GS) soil samples collected at the McLeish Field Station. The goal of our summer was to estimate the number of positive interactions for the FSS and GS bacterial populations and use the data in models and cellular automate in the future. We tested for positive interactions between the 25 isolates from the FSS group and 53 isolates from the GS group. For both populations the experiments were executed three times. If an isolate was 2 or 3 times positive on a certain indicator lawn, the summary score would be positive and visa versa. This resulted in an FSS interaction matrix of 25x25 and a GS interaction matrix of 53x53, of which 26.4 % and 37.5 % were positive for FSS and GS respectively ($P=0.02$, Heteroskedastic, one sided Ttest). This observation supports the idea that antibiotic production is mediated by competition and is more important in environments with a higher bacteria load (CFU GS> CFU FSS). Furthermore, the expected number of gram-positive isolates inhibiting gram-negative isolates is highly underrepresented ($0.01 > p > 0.001$ and $p < 0.001$ for FSS and GS respectively, using Chi2), indicating that cell-type (gram-positive (presence of a cell wall) and gram-negative (lack of a cell wall)) substantially affect the outcome of competition. We hypothesize that the inability of gram-positive bacteria to inhibit the growth of gram-negative bacteria could be due to a secondary metabolite that targets the cell wall, which is ineffective against gram-negative bacteria. Among both the FSS and GS populations, we found the most positive interactions (isolate producing an antibiotic that inhibits the growth of the lawn) when placing gram-positive producers on a gram-negative lawns. In order to visualize our data we employed CytoscapeTM (3.6.1) which enabled us to map out all of the interactions between each of the bacterial genera. Interestingly, despite different populations, the interactions between the GS and FSS had very similar topography with the following differences: there were more interactions between gram-negative lawns and gram-negative producers in FSS, and more interactions between gram-positive lawns and gram-positive producers in GS.

SURF 2018-Post SURF Survey

Name	Luya Gao
Year of Graduation	2019

Are you in a Graduate program?	no
SURF Advisor	Susan Voss, Engineering
Advisor Department	Engineering
SURF Field of Study	Wideband Acoustic Immittance Measurements
Upload image(s) in .png format; 1,100 MB max size each	 SURF Abstract.PNG
Title of Abstract/Research	Investigation of the effect of using different methods of taking wideband acoustic immitance (WAI) measures have on the end result
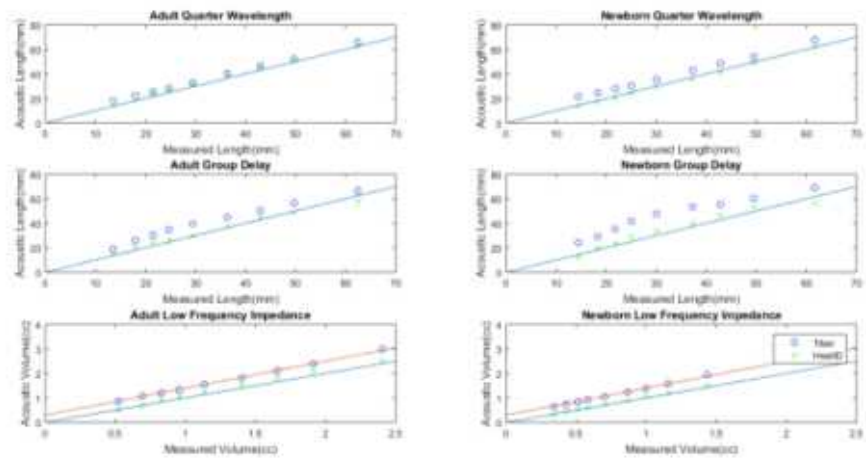
Please type your abstract below.

This summer I worked with Sandy Shi in Professor Susan Voss' Lab on WAI measurements (Wideband Acoustic Immittance) that can be used to describe sound transmission through the middle ear. Two instruments are often used to make such measurements (Titan by Interacoustics and HearID by Mimosa), but it has been observed that they often give different measurements on the same ear. Our hypothesis was that this difference results from different distances between the probe and the tympanic membrane, since the probe of HearID is typically inserted deeper into the ear canal.

To examine our hypothesis, three approaches were applied to estimate the difference in the distance between the probe and the tympanic membrane between the two instruments: quarter wavelength, low frequency impedance and group delay. For the quarter wavelength method, we analyzed the frequency at which the impedance had a sharp minimum that corresponded to the quarter wavelength resonance. For the low frequency impedance method, we assumed the impedance was dominated by a compliance and estimated the corresponding ear-canal volume difference. For the group delay method, we applied the relationship between group delay of immittance at higher frequencies and ear canal length stated in another paper.

We tested the three methods with measurements in tubes to check if our methods could be relied upon to give repeatable and reliable results. There were two sets of tubes available, with diameters of 5.45mm and 7mm. The tubes in each set were of varying lengths, ranging from 1.2cm to 6.1cm. In the plot attached, the estimated cavity lengths deduced from WAI measurements were plotted against those measured using a caliper, with a y=x line attached for comparison. For the quarter wavelength method, the lengths deduced from WAI measurements are very close to the actual value for both instruments and for both sets. For the group delay method, HearID gives estimates very close to the true value, but Titan's estimates have larger errors. For the low frequency impedance method, Titan's estimates fall on the line y=1.1x+0.3 instead of y=x, suggesting the difference in volume between measurements would be quite close to the true difference, with a 10% error. The results confirm our hypothesis that when the cavity between the probe and the wall is controlled to be of the same length, the WAI measurements made on the same ear by the two instruments are virtually identical.

SURF 2018-Post SURF Survey

Name	Guinevere MacDonald
Year of Graduation	2019
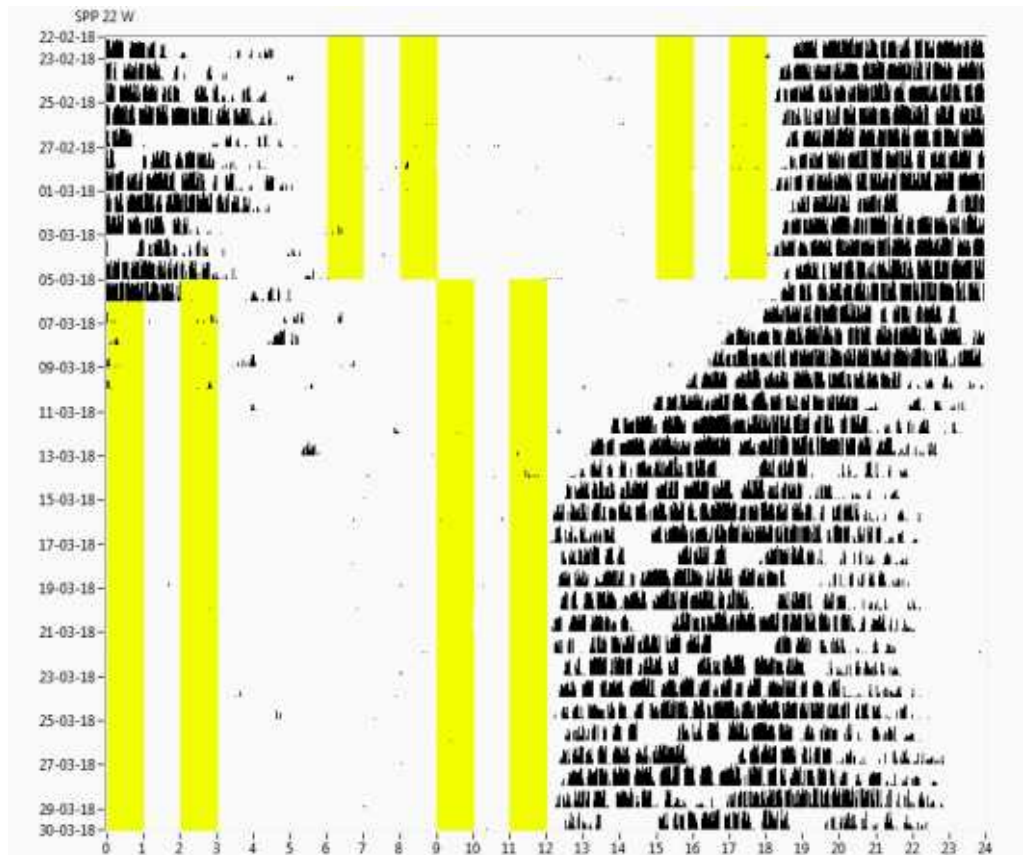
Are you in a Graduate program?	no
SURF Advisor	Mary Harrington, Neuroscience
Advisor Department	Neuroscience
SURF Field of Study	Neuroscience
Upload image(s) in .png format; 1,100 MB max size each	SPP 22 W_Actogram.png
Title of Abstract/Research	Mastering the Technique of Measuring Jet Lag with a Skeleton Photoperiod

Please type your abstract below.

Jet-lag is a condition that arises when the internal biological clock of the body is misaligned with the environmental clock of the environment. This desynchrony causes misalignments in circadian period between the body's central pacemaker, the suprachiasmatic nucleus, and peripheral organs such as the liver.

New in vivo bioluminescence techniques allow us to investigate how advances and delays in environmental light affect the circadian rhythms of organs in the body of a living mouse. With this new technology genetically engineered mice are made to have a luciferase gene connected to a circadian clock gene (Per2) of a specific organ. With the administration of bioluminescent compounds the in vivo chambers are able to pick up bioluminescence from the mice which are a direct measurement of circadian period. To identify the internal desynchrony that is caused by advances of the light cycle using the in vivo technique minimal light is necessary in order to collect bioluminescence data. Skeleton photoperiods are short light pulses at the beginning and end of the light period. Studies have shown that mice can stay entrained to a 12:12 cycle with a single hour of light in the beginning of the 12 hour day period and an hour of light at the end. Research conducted in the Harrington Lab showed that mice are able to behaviorally entrain to an advancement with a skeleton photoperiod light schedule however the phase of the SCN throughout the entrainment is unknown. Studies have shown that neuronal activity occurs for 1-3 days in the SCN after an advancement with a full light cycle. This summer we aimed to see if the same level neuronal activity occurs in response to jet lag with the skeleton photoperiod protocol developed by the Harrington Lab.

Neuronal activation will be measured by c-Fos immunohistochemistry with mice that endured a six hour advance in a skeleton photoperiod light cycle. This data will give us the knowledge if the skeleton photoperiods are able to entrain mice to advancements not only as they have shown to behaviorally but neurologically as well. This is necessary to understand before moving forward with experiments involving the in vivo technology because we will have a knowledge of the activity phase of the SCN while the in vivo box is measuring the rhythms of peripheral organs.

Figure 1. Actogram of wheel movement throughout skeleton photoperiod advancement.

SURF 2018-Post SURF Survey

Name	Basira Daqiq **Smith**
Year of Graduation	2021

Are you in a Graduate program?	no
SURF Advisor	Sarah Moore, Engineering
Advisor Department	Engineering
SURF Field of Study	Bioengineering
Please list co-authors of your abstract	Jessica Bonsu
Title of Abstract/Research	Engineering protein to Bind to Transferring receptor for diagnostic and therapeutic purposes
Please type your abstract below.	The Blood Brain Barrier (BBB) prevents damaging substances and materials from entering the Central Nervous System (CNS). Although the BBB plays an important role in keeping the CNS stable, it also prevents drugs from entering the CNS to treat disorders such as Alzheimer's and Huntington's disease. Professor Sarah Moore's lab focuses on engineering proteins that can transfer drugs into the CNS that will have therapeutic and diagnostic effects on central nervous system diseases. We have used the internalization pathway of an iron-carrying protein, transferrin, which binds to the transferrin receptor, to design a strategy to transport drugs into the CNS. We are engineering proteins to mimic the natural internalization pathway of transferrin by binding to the transferrin receptor and subsequently delivering drugs to the CNS through the BBB. Specifically, this summer, my labmate, Jessica Bonsu, and I worked to improve the expression and solubility of proteins that were previously engineered to bind to the transferrin receptor. To do this, we worked on attaching C-myc and Cys peptide tags to our engineered protein scaffold, Fibronectin Type III (Fn3). We added the tag to the C-terminus (the end) of the Fn3 protein to prevent any disturbance to the binding properties of our engineered protein. We successfully used recombinant DNA methods to generate all engineered protein variants with the C-myc and Cys tags. Our preliminary results indicate that our modified proteins can be expressed in bacteria, but that the proteins still present difficulties with solubility, which will be addressed during continued research.

SURF 2018-Post SURF Survey

Name	Sara Elmourabit
Year of Graduation	2020

Are you in a Graduate program?	no
SURF Advisor	Peter de Villiers, Psychology
Advisor Department	Psychology
SURF Field of Study	Psychology
Upload image(s) in .png format; 1,100 MB max size each	

Impact of Lower Income Mothers Language on Their Children's Later Reading

The field of psycholinguistics, especially in terms of mothers and their children, holds an undeniable importance to learning. The correlation between mothers' language and its effects on their children has been studied and concluded that language plays a vital role in children's language development and learning. Previous research has shown that the development of language in early childhood is paved through social interactions between the child and their caregiver (Tomacello, 1992). In the De Villiers study, African American mothers and their children were videotaped in 10 minute playing sessions and transcribed as part of a longitudinal study. Children ranged from ages 3-5 (mean= 4). Later the transcriptions were coded using Scarbrough's (1990) IPSyn for the mother's utterances during the 10 minute play time and then were coded for their use of AAE. Children were measured for their reading levels using Woodcock-Johnson's III Passage Comprehension subtest and measured for their vocabulary production and phonological awareness using the TOPEL test.

When factors are controlled, the grammatical richness of a mother's input can directly affect children's first grade reading level. In a linear hierarchical regression analysis, 60 mothers were tested on their grammatical richness and how much it affected their children's reading levels. Aside from just the mother's language, variables like richness of vocabulary and its complexity was explored on how this also affected children. During the summer the subject sample for the study has been extended to about 80 mothers and it has been found that the correlations have only gotten stronger. Furthermore, Hispanic and African American mothers were tested for data on their affects on their children. African American mothers were tested for their grammatical richness as well as their use of African American English (AAE), which also was another variable in the study. Hispanic mothers were tested on their mixture of English and Spanish usage, and how that affected their children. Approximately 20 Hispanic mother-child pair play sessions have been transcribed, coded for the mothers' language in both English and Spanish for vocabulary and syntactic "richness." African American mothers were also transcribed and scored for their use of AAE.

Research in this area has shown an underlying importance of mother's language and its effects on children's language and vocabulary development. Research in this field will help children and parents be better equipped to understand children development and language acquisition. It will also help parents understand how the richness of their vocabulary and verbal

SURF Abstract png.png

Title of Abstract/Research	Impact of Lower Income Mothers Language on Their Children's Later Reading

Please type your abstract below.

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Research in this area has shown an underlying importance of mother's language and its effects on children's language and vocabulary development. Research in this field will help children and parents be better equipped to understand children development and language acquisition. It will also help parents understand how the richness of their vocabulary and verbal interaction with their children can have a tremendous impact on their children's understanding and learning, especially in their future.

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Seitz, S., & Marcus, S. (1976, May 1). Mother-Child Interactions: A Foundation for Language Development. Retrieved September 2, 2018, from http://journals.sagepub.com/doi/abs/10.1177/001440297604200805

Scarborough, H., van Kleeck, A., Gillam, R. B., Hamilton, L., & McGrath, C. (1997). Index of productive Syntax. Journal of Speech, Language, and Hearing Research, 40, 1261-1271.

Tomasello, M. (1992). First verbs: A case study of early grammatical development. Cambridge: Cambridge University Press. http://dx.doi.org/10.1111/j.1467-9507.1992.tb00135.x

Table 1: Parent-Child Responses during 20 minute play time

SURF 2018-Post SURF Survey

Name	Nadia PenkoffLidbeck
Year of Graduation	2021
Are you in a Graduate program?	no
SURF Advisor	Michael Baressi, Biological Sciences
Advisor Department	Neuroscience
SURF Field of Study	Biology and Neuroscience
Please list co-authors of your abstract	J. Schnabl, M. Litz, M. Schwartz, M. J. Barresi

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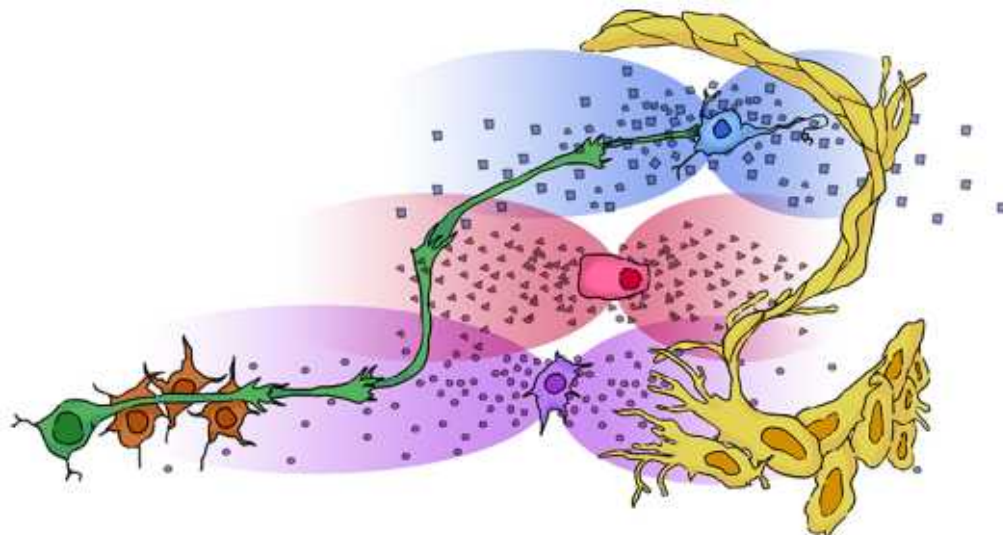
signal model n penkofflidbeck.png

Title of Abstract/Research

Building a complete tool kit to understand how Slit guidance cues build the zebrafish forebrain.

Please type your abstract below.

Communication between the two sides of the nervous system occurs through specific midline crosses known as commissures. During early embryonic development, commissural axons are guided across the midline by cues that function to attract, repel, or somehow facilitate the growth of axons (see figure). Slits are one family of signaling proteins known to function as repellent cues to prevent the inappropriate pathfinding of axons. To better understand the role of slit1a, slit2, and slit3 in the guidance of axons and cell migration during commissure formation, we take advantage of studying the simplicity of the post optic commissure (POC) in the embryonic zebrafish forebrain. Research has shown morpholinos can knock down specific slits in the brain and defasciculate the POC. From this, we have learned that Slit2 and Slit3 proteins help condense the glial bridge and commissural axons during POC development. An additional Slit, slit1a, has been shown to have a different expression pattern than slit2 or slit3, and has been suggested to have a different role in POC formation than the other slits. Furthermore, we have seen overexpression of slit1a to partially rescue POC development, suggesting that slit1a may serve as a chemoattractant, contrary to other published literature on slits. We investigate the role of slit1a in POC formation, to determine whether slit1a acts as a novel chemoattractant to commissural axons or glial bridge glia in the zebrafish POC. I utilized a slit1a knockout model, previously developed in the Barresi lab, with a concurrent knockout of slit2 and slit3 to determine the individual and cumulative effects of these slits on POC development. This summer, we further analyzed the loss of slits by generating new CRISPR knockouts of slits to continue studying the effects of slit guidance on commissure development. We genotyped adult fin clip and embryo DNA samples, and worked to characterize the possible POC defects present in these embryos. These POC phenotypes are characterized by performing immunocytochemical labeling of POC axons and glia and collecting images of embryo forebrain mounts on the Leica Scanning Confocal Microscope. We also began the study of migration abilities of neural crest cells in 6 hpf embryo head separations which were grown to 28 hpf in media and analyzed for commissure development on varying degrees depending on amount of hindbrain.

SURF 2018-Post SURF Survey

Name	Emily Raphael
Year of Graduation	2018

Are you in a Graduate program?	yes
SURF Advisor	Michael Baressi, Biological Sciences
Advisor Department	Biological Sciences
SURF Field of Study	Biology Education
Please list co-authors of your abstract	Stephanie Konas
Title of Abstract/Research	Student Scientists Outreach Program

Please type your abstract below.

The Smith College Student Scientists Outreach Program (SSOP) brings zebrafish from the Barresi Lab, as well as inquiry based curriculum, into middle schools and high schools throughout the Pioneer Valley. The purpose of the program is to provide teachers with Smith College's cutting edge resources to help them teach a variety of units including, genetics, growth and development, and ecology and ecosystems. Our group works closely with teachers to effectively integrate the program's materials for a diverse set of courses, working to improve students' critical thinking skills and spark interest in Science, Technology Engineering, and Math (STEM).

We have worked this summer to develop curriculum that balances teacher autonomy with standardization, drawing from Next Generation Science Standards and the Programme for International Student Assessment (PISA). Using data collected over the school year from STEM identity surveys and critical thinking assessments, we determined that students had slight increase in testing scores, indicating the positive influence of the SSOP. However, grader bias and student participation could have influenced the results of these tests, so we developed a more thorough and precise assessment that determined student's ability to apply the scientific inquiry method to different fictional scenarios (Figure 1).

Alongside our work with curriculum and assessment, we created a website to increase accessibility for students and teachers, bred and researched new zebrafish genetic variates to be used in the program, and matched our curriculum to the chosen standards for the Massachusetts public school system. To continue funding the SSOP, we also helped submit an iTEST grant that will ensure the sustainability of the program. Overall, the SSOP uses college resources, such as zebrafish, to further develop students' understanding of inquiry based science and inspire the next generation of scientists.

Figure 1. Example of a critical thinking assessment developed this summer. Art by Nadia PenkoffLidbeck student in the Barresi Lab.

SURF 2018-Post SURF Survey

Name	Evie Hoffman **Smith**
Year of Graduation	2020
Are you in a Graduate program?	no
SURF Advisor	Laura Katz, Biological Sciences
Advisor Department	Biological Sciences
SURF Field of Study	Biological Sciences
Upload image(s) in .png format; 1,100 MB max size each	

Figure 1. Light microscopy of foraminifera. A. *Cibicides*-like. B. *Bolivina*-like. C. *Ammonia*-like test. D. *Milliamina*-like test. E. *Bolivina*-like with pseudopods. F. Unknown foram with pseudopods. A, B, E and F are from the aquarium in Burton Hall at Smith College. C and D are from Milford, CT. All images by EH.

ehoffman.png

Title of Abstract/Research	Community Dynamics of Foraminifera

Please type your abstract below.

Foraminifera are a group of microorganisms that live in aquatic environments, in both marine and (more rarely) freshwater. They are shelled (testate) and use thin, filose pseudopodia (false-feet) for amoeboid movement. Foraminifera tests often fossilize, and are thus commonly studied to learn about past environmental conditions. Moreover, foraminifera have unusual genome processes including Zerfal, a process whereby nucleic acids are removed from nuclei prior to cell division. The unusual genomic processes in foraminifera suggest that this lineage of amoebae may be able to distinguish between somatic and germline material.

This summer, I began working on a foraminifera community project, the goals of which are to characterise and compare community composition within and between sites. For this project, I used both light microscopy and molecular methods such as DNA isolation, PCR, Whole Genome Amplification (WGA) and Sanger Sequencing. I worked to develop a procedure for collecting and processing samples. I sampled mainly from three locations: Milford, CT, Madison, CT, and the aquarium in Burton Hall at Smith College. While I found the presence of living foraminifera through molecular methods at all three sites, only the aquarium samples yielded living foraminifera through microscopy (Figure 1). I also identified two morphospecies (Bolivina sp and Cibicides sp) from the aquarium samples using Sanger Sequencing of WGAs. The methods developed in this project can be used to asses community composition of foraminifera and compare the diversity both within and between sites.

SURF 2018-Post SURF Survey

Name	Savannah Pees
Year of Graduation	2019

Are you in a Graduate program?	no
SURF Advisor	Maren Buck, Chemistry
Advisor Department	Chemistry
SURF Field of Study	Polymer Chemistry
Upload image(s) in .png format; 1,100 MB max size each	
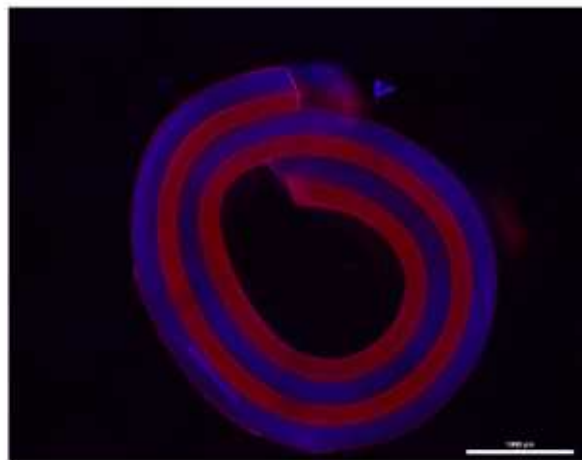
Figure 1. Fluorescent image of a rolled gel taken with a Nikon Eclipse E200 Microscope. The PEG-400 layer, shown in red, is labeled with tetramethyl rhodamine, and the PEG-200 layer, shown in blue, is labeled with dansylcadaverine.

Screen Shot 2018-09-06 at 1.42.52 PM.png

Title of Abstract/Research	Characterization of the self-rolling abilities and biocompatibility of PEG crosslinked azlactone hydrogels

Please type your abstract below.

Poly(2-vinyl-4,4-dimethylazlactone) (PVDMA), an azlactone-functionalized polymer, can be used to create hydrogels with tunable chemical and physical properties. PVDMA hydrogels can be adapted to meet the wide range of conditions required by various cell types and experimental parameters, making them a favorable substrate for use in tissue engineering or as synthetic, 3D extracellular matrices (ECM) for in vitro biological research. These hydrogels are beneficial to the field because they offer a fully defined alternative to animal-derived ECM and are better able to mimic in vivo conditions than stiff 2D cell culture substrates. [1] PVDMA hydrogels formed using the diamine crosslinker "Jeffamine" are capable of self-rolling and are a possible substrate for tissue culture [2]. This project sought to characterize these properties of PVDMA hydrogels when poly(ethylene glycol) (PEG) is used as the crosslinking agent.

To form self-rolling hydrogels, we cast two 0.22 mm layers of polymer with crosslinkers of different molecular weights on top of each other. The layers swell to different degrees when submerged in phosphate buffered saline, causing the gel to roll into a tube. Our research determined that bilayer PVDMA hydrogels crosslinked with 400 g/mol PEG and 2000 g/mol PEG are capable of self-rolling. (Fig. 1). We also sought to characterize the biocompatibility of PEG-crosslinked hydrogels by seeding mouse embryonic fibroblasts (MEF-3T3) onto 1 mm thick unfuctionalized gels. Using phase contrast microscopy and a fluorescent LIVE/DEAD stain, we found that MEF-3T3 cells do not reliably adhere to PEG-crosslinked gels that are unfunctionalized or functionalized with PEG compounds of different molecular weights.

Characterizing the behavior of different types of PVDMA hydrogels will allow us to better predict and control the behavior of the gels. Future research will focus on using synthetic peptides to encourage cell adhesion to the PEG-crosslinked hydrogels as well as using the rolled bilayer gels as a cell culture substrate. This will further demonstrate usefulness of PVDMA to the growing tissue engineering field.

SURF 2018-Post SURF Survey

Name	Yolanda Nyasha Chigiji
Year of Graduation	2021

Are you in a Graduate program?	no
SURF Advisor	Judith Cardell, Engineering
Advisor Department	Engineering
SURF Field of Study	Electrical Engineering
Please list co-authors of your abstract	Katie McCann
Title of Abstract/Research	Demand Response
Please type your abstract below.	In the US, in order for the electrical grid to function most optimally, power companies must keep the current at a steady 60 Hz. A deviation of only 0.5 Hz from the ideal will result in necessary load shedding to maintain optimal frequency. To keep the grid running properly, power companies must constantly make adjustments in their supply to meet demand. At peak demand periods, when the power company is reaching their max capacity, it becomes necessary to get creative. Demand response programs provide one method of controlling demand during peak periods. In essence demand response is where a consumer, usually a large commercial business, reduces their load during peak demand periods in exchange for financial incentives. If these programs are successful they have potential to be used in combination with wind energy. To determine how effective these programs are, we have been collecting data from the six main independent system operators (ISO) in the US; CAISO, ERCOT, ISOne, MISO, NYISO, and PJM. By comparing their popularity, cost effectiveness, and convenience, we can hypothesize whether or not these programs can be a successful long term solution to fluctuations in wind energy.

SURF 2018-Post SURF Survey

Name	Lizzette Perez-Perez
Year of Graduation	2019

Are you in a Graduate program?	yes
SURF Advisor	Steven Williams, Biological Sciences
Secondary SURF Advisor	Kevin Shea
Advisor Department	Biological Sciences
SURF Field of Study	Molecular Biology
Please list co-authors of your abstract	Susan Hyanes, Jessica Grant
Title of Abstract/Research	Anti-filarial Activity of Natural Neurolenin D and Synthetic Neurolenin Derivatives
Please type your abstract below.	Lymphatic filariasis (LF) is a neglected tropical disease that threatens 52 countries and over 1 billion people. There are drugs available to treat LF; however, they are ineffective against adult worms, potentially toxic when people have other infections, and prolonged administration has led to emerging drug resistance. Thus, there is an urgent need to develop a novel, safe and affordable drug that is able to kill adult worms without causing side effects. Our work has focused on studying the bioactivity of neurolenin D, available from Neurolaena lobata, and synthetic analogs against the lymphatic filarial parasite B. pahangi. These analogs were created by modifications of the neurolenin scaffold including esterification at the reactive secondary alcohol position. Their bioactivity was measured in vitro against male and female adult nematodes by adding one dose (3µg/mL) of the respective drug and then monitoring nematode mortality over a period of 100 hours. Interestingly, the activity of neurolenin analogs varies between male and female nematodes, indicating the presence of some mechanism resulting in gender selectivity. The bioactivity of neurolenin D and the most promising analogs will be further tested by means of RNAseq analysis comparing untreated and treated B. pahangi male and female adults. Studying the effect of the drugs on the transcriptome will provide us with information on the mechanism of action of these compounds. These results will provide further useful data on neurolenin and its analogs as promising alternatives for the treatment of LF and perhaps other neglected tropical diseases caused by nematode parasites.

SURF 2018-Post SURF Survey

Name	Anne Lepow **Smith**
Year of Graduation	2020

Are you in a Graduate program?	no
SURF Advisor	John Brady, Geosciences
Advisor Department	Geosciences
SURF Field of Study	Geosciences
Title of Abstract/Research	Developing a Rock Database: How technology can aid in the teaching of petrology
Please type your abstract below.	A rock library was complied to aid students in the classification and identification of common igneous and metamorphic rocks and in the development in pattern recognition, a key skill for students of petrology. The rock library consists of several pages of relevant information regarding each rock, along with hand sample, thin section, and field photos. The rocks are defined according to the standards set forth by the International Union of Geological Sciences in order to prevent confusion over varying definitions. This enables students to confidently interact with and identify rock samples based on community standards. High resolution photographs of hand samples were taken and added to the rock library. These photographs provide the means for students to engage with a wide variety of rock types, even without a physical sample. Additionally, for each rock in the rock library, a list of common minerals was assembled. This list is crucial in that it allows students a more in-depth look at which minerals are commonly associated with specific rock types. This, along with the high resolution images of each rock facilitates in the development of pattern recognition. The rock library consists of essential information regarding most varieties of igneous and metamorphic rock. By presenting a variety of photographs for each rock, the rock library makes it possible for students of petrology to gain fundamental identification and pattern recognition skills without interacting with physical rock samples.

SURF 2018-Post SURF Survey

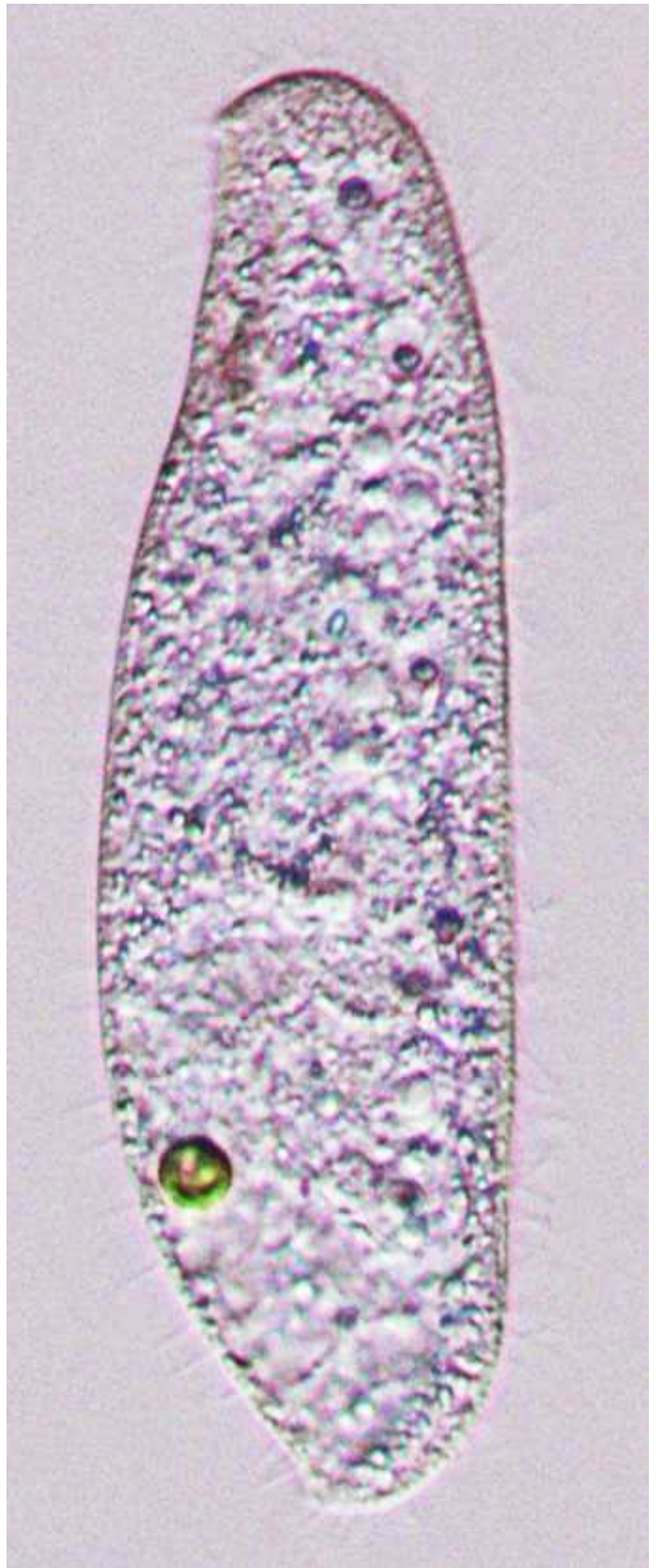|	
Name	Sakina Ali
Year of Graduation	2021
Are you in a Graduate program?	no
SURF Advisor	Laura Katz, Biological Sciences
Advisor Department	Biological Sciences
SURF Field of Study	Organismic and Evolutionary Biology

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Loxodes.png

Title of Abstract/Research	Identifying Uncultivable Ciliates and Analyzing Ancient Gene Duplications
Please type your abstract below.	My research this summer consisted of working simultaneously on two projects with two different teams in the KatzLab with the goals of understanding how a lab functions and learning basic molecular and bioinformatic skills. The first project consisted of working with different ciliates deemed to be uncultivatable by a number of factors and identifying them by sequencing their genomes (mostly DNA) using ACTIN and SSU rRNA primers [4]. Ciliates are eukaryotic unicellular protists that are characterized by their possession of cilia and by their somatic nuclei and germline nuclei. They belong to the SAR group under the major clade Alveolata and are usually found in marine and freshwaters [2]. After they were collected from both marine water and freshwater at Silver Sands Beach, Hawley Bog and Paradise Pond, samples were filtered and single cells were picked for whole genome amplification (WGA) using kits and protocols provided by the lab. The genera that I focused on were an unknown species of Chilodonella, a species that looked like chilodonella (chilo-like), Halteria, and some Karyorelictea (pictured below). Once the genomes were amplified, using the KatzLab Sanger Sequencing protocol, which included PCR, PCR purification and sequencing, I ran the sequences against the NCBI database to find if there are any matches [4]. Other skills that I learned while working with ciliates were how to stain the nuclei to potentially track developmental genome changes by fixing cells, DAPI staining them and looking at them under UV light [5].

My second project consisted of doing more analysis on already sequenced genomes to find patterns that help explain distinct evolutionary concepts and the eukaryotic 'tree of life'. Specifically, I used several bioinformatic tools such as BLAST and Guidance as well as wrote Python scripts to examine and characterize genes involved in ancient gene duplications [1]. Initially, I had only started investigating crucial enzymes involved in photosynthesis. The old theory is that organisms that have a photosynthetic gene come from a single origin (ancestor). However, there is a new theory deemed the 'shopping bag' theory, which suggests there are multiple origins [3]. Later, I also started working on more ancient genes that the NCBI database characterizes under gene families (OGs). We assume that some genes that are grouped under different OGs should actually be under a single OG. My goal was to set up an algorithm that regroups genes and perform to tests to speak to the validity of our project and is something I will continue to work on in the Fall.

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2. Foissner, W., Chao, A., & Katz, L. A. (2007). Diversity and geographic distribution of ciliates (Protista: Ciliophora). Protist Diversity and Geographical Distribution Topics in Biodiversity and Conservation,111-129. doi:10.1007/978-90-481-2801-3_9
3. Larkum, Anthony W.D., Lockhart, Peter J., Howe, Christopher J. 2007. Shopping for plastids. Trends in Plant Science , Volume 12 , Issue 5 , 189 - 195.
4. Xyrus X. Maurer-Alcalá, Rob Knight, Laura A. Katz.(2018). Exploration of the Germline Genome of the Ciliate Chilodonella uncinata through Single-Cell Omics (Transcriptomics and Genomics). Volume 9 Issue 1 mBio 9:e01836-17.
5. Yan, Ying, Rogers, Anna J., Gao, Feng, Katz, Laura A. 2017. Unusual features of non-dividing somatic macronuclei in the ciliate class Karyorelictea. Elsevier GmbH. |

SURF 2018-Post SURF Survey

Name	Julia Kim
Year of Graduation	2019

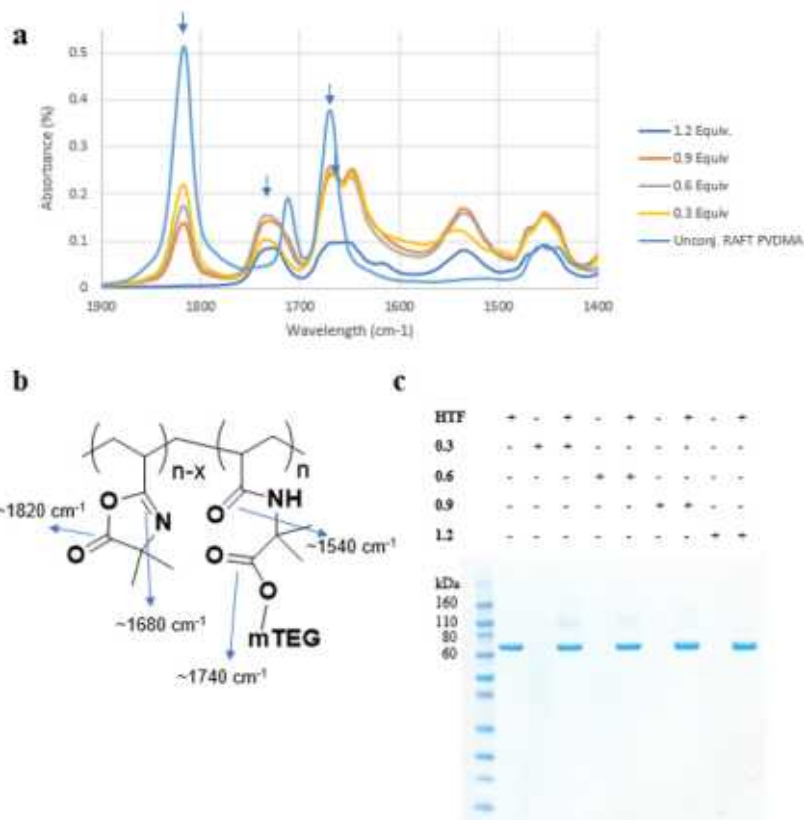|	
Are you in a Graduate program?	no
SURF Advisor	Maren Buck, Chemistry
Advisor Department	Chemistry
SURF Field of Study	Polymer Chemistry
Upload image(s) in .png format; 1,100 MB max size each	

Figure 1. Characterization of the conjugation of mTEG and proteins to the RAFT PVDMA. (a) FTIR data of the conjugation of RAFT PVDMA with 0.3-1.2% functionalization with mTEG (b) IR peaks of unopened and opened azlactone rings. (c) SDS-electrophoresis gel demonstrating polymer conjugation holo-transferrin conjugation.

J_Kim_Figure.PNG

Title of Abstract/Research	Designing Protein Polymer Conjugates for Drug Delivery

Please type your abstract below.

Two respective problems are prevalent in current treatments of cancer and diseases of the central nervous system (CNS). Cancer treatments often involves chemotherapeutics that are unable to specifically target the cancerous tissue while treating diseases of the CNS effectively is hindered by the blood brain barrier (BBB). A possible solution to both issues lies in utilizing protein polymer conjugates (PPCs). The protein would allow for specific targeting, while the hydrophilic polymer scaffold would be able to attach the drug to the protein. The hydrophilic polymer scaffold has an additional benefit in improving the circulation hydrophobic drugs that are common in chemotherapeutics.

This project is in collaboration with the Moore lab, where the proteins are engineered for specific targeting and where previous members of the lab have demonstrated successful conjugation of model proteins—lysozyme, BSA, and holo-transferrin—to the polymer scaffold. It was further demonstrated using confocal microscopy that holo-transferrin PPCs can specifically target and internalize via the transferrin receptors on the surface of MCF-7 cells. Cells in the blood brain barrier have a high concentration of transferrin receptors, and the successful internalization studies, suggests its effectiveness in overcoming the BBB.

The past results however, relied on making the polymer scaffolds via uncontrolled polymerization. This technique results in a large disparity in the molecular weights of the scaffolds. The varying molecular weights are likely to result in some PPCs to function more effectively than others in specific targeting. Additionally, the higher molecular weight PPCs can accumulate in the liver resulting in undesirable damage. Therefore, the focus of this project is in utilizing reversible-addition fragmentation chain-transfer (RAFT) polymerization to control the size of the polymer scaffolds. Differing molecular weights of RAFT Azlactone polymers [poly(2-vinyl-4,4-dimethylazlactone)] were functionalized with hydrophilic side chains--triethylene glycol monomethyl ether—before being conjugated to model protein holo-transferrin. The successful conjugation was demonstrated by SDS-electrophoresis. We are currently working on internalization studies of the RAFT PPCs and comparing the efficiencies of differing molecular weights with the uncontrolled PPCs.

SURF 2018-Post SURF Survey

Name	Hening Zheng
Year of Graduation	2020

Are you in a Graduate program?	no
SURF Advisor	R.Jordan Crouser, Statistical and Data Sciences
Advisor Department	Computer Science
SURF Field of Study	Computer Science/Statistical and Data Science
Please list co-authors of your abstract	Sherry Zhenyao Cai, Chen Li, Chris Xiaoyue Tan, Starry Yujia Zhou
Title of Abstract/Research	Smith College Learning Space Assessment

Please type your abstract below.

In 2017-2018, Smith College contracted Sasaki Associates, Inc. to conduct a survey of Smith College study space analysis. During the summer of 2018, five undergraduate student researchers in the Human Computation and Visualization Laboratory conducted additional analysis of the collected data under the supervision of Prof. R. Jordan Crouser.

This reanalysis of Smith Space Usage focused on evaluating utilization rates, technology deployment, campus geography and the physical condition of classroom spaces. The goal of this study is to identify potential methods to support faculty with their diverse pedagogy and enhance student learning experiences. The assessment was summarized as the convergence of the following two themes: Teaching, and Allocating. There are several essential goals we achieved at the end of this summer: (1) analyzed the correlation between Sasaki's scoring system and our own scoring system (HCV score); 2) examined the relevance of Sasaki' scores and faculties and students' preferences for classrooms to valid the reliability of Sasaki's scoring system; (3) studied other features that might faculties and students' preferences, which includes "number of seats" and "faculty member's academic rank "; (4) analyzed general usage of classrooms, whose topics include frequency of classrooms being used, average fullness and usage standard deviation and chair usage efficiency; (5) Develop a decision-making interface to help resource allocation and room assignment; (6) wrote a white book "Smith College Learning Space Assessment Report" to document and explain our research on Smith College space usage.

In future study on this dataset, we would like to advance the research on the following aspects:

We would like to further our study on how distance of a classroom to one's workspace or dorm room influences their preferences of it. We speculate that distance is an important aspect of the accessibility of study spaces for students. However, because the survey on faculties' and students' classroom preferences are all anonymous, we cannot conduct further analysis based on this data. Therefore, we would like to suggest Smith College Office of Institutional Research to add questions that address people's locations in the next survey. To accelerate the process of classroom assignment, we would like to include schedule into consideration. We would like to utilize To have each class associated with its time block, we could advance the current web interface to work on the scheduling much clearer and more efficient to come up with a more comprehensive schedule.

SURF 2018-Post SURF Survey

Name	Yujia Zhou
Year of Graduation	2020

Are you in a Graduate program?	no
SURF Advisor	R.Jordan Crouser, Statistical and Data Sciences
Advisor Department	Statistical and Data Sciences
SURF Field of Study	Statistical and Data Science
Please list co-authors of your abstract	Xiaoyue Tan, Hening Zheng, Chen Li, Zhenyao Cai
Title of Abstract/Research	Smith College Learning Space Assessment

Please type your abstract below.

In 2017-2018, Smith College contracted Sasaki Associates, Inc. to conduct a survey of Smith College study space analysis. During the summer of 2018, five undergraduate student researchers in the Human Computation and Visualization Laboratory conducted additional analysis of the collected data under the supervision of Prof. R. Jordan Crouser.

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To accelerate the process of a classroom assignment, we would like to include schedule into consideration. We would like to utilize To have each class associated with its time block, we could advance the current web interface to work on the scheduling much clearer and more efficient to come up with a more comprehensive schedule.

| **Please type your abstract below.** | 1.3 million people die in road crashes each year with an average of 3,287 deaths a day. More than half of all road traffic deaths occur among young adults ages 15-44. This research attempts to understand driving behavior among adolescents between 15 and 19 years old by studying their socioeconomic background. Throughout the research, I have been analyzing a dataset from Add Health, a longitudinal study where approximately 15000 high school students have been asked the same questions 6 times over the past 24 years. My analysis focused on the first two waves of the study as they contain adolescents who are between 15 and 19 years old.

Dependent variables that describe driving behavior were: Seatbelt usage, illegal driving behavior, driving behavior after consuming alcohol, driving behavior while drunk, and driving behavior while high. Independent variables that describe socio-economic background are: feeling of safety in neighborhood, allowance per week, public assistance, crime in neighborhood, illegal drug act, problem with drug dealers, Social Security Income, aid to families with dependent children, food stamps, house subsidies, education level of parents, and ability to pay bills.

A multiple regression test for each independent variable allowed the selection of the socio-economic variables that best explain driving behavior. The two highest variability explained was that of illegal driving behavior and driving after alcohol consumption. Multiple regression indicated that 16.5 % of the variability in adolescent's behavior around illegal driving is best explained by safety feeling in neighborhood, students allowance per week and drug dealer issues. For behavior after alcohol consumption, 4.9% of the variability is best explained by the parent's feeling of safety in neighborhood, whether any member of the household received house subsidies over the past month and allowance per week received by the student.
A score was given to each student during wave 1 and wave 2 according to how they responded to the driving behavior questions. The Bubble chart displays the score change from wave 1 to wave 2 along with the education level of the parents and the adolescent's age. The two major parents' education among students whose behavior worsened are parents who graduated from high school and parents who went to college but did not graduate.
These results will help in designing further clinical research that prevents risky driving behavior of adolescents. |

SURF 2018-Post SURF Survey

Name	Bethany Stoddard
Year of Graduation	2020

Are you in a Graduate program?	no
SURF Advisor	Jill de Villiers, Psychology
Advisor Department	Psychology
SURF Field of Study	Language Acquisition
Title of Abstract/Research	Negated Adjectives and Mitigation

Please type your abstract below.

The interpretation of adjectives is complicated by the fact that their meaning is often context dependent, for example, "big" mouse is not equivalent in size to a "big" elephant. What's more, different types of adjectives interact differently with negation. Sometimes the negation of one adjective in a pair is roughly equivalent in meaning to the affirmative opposite, as with "not alive" and "dead". However, it is often the case that the negated adjective is interpreted with a meaning distinct from its opposite. This is referred to as the mitigating effect, as for example with "not sad," which doesn't necessarily mean "happy." So, how do children handle opposite adjective pairs then, and are they sensitive to the mitigating effect?

This project continued the work of recent Smith alumna Xiaozhao Wang. Using a picture sorting tasks, she tested children ages 3-5 and adults to see whether the mitigating effect could be observed in their interpretation of three different types of adjective pairs. In this study, the participants were presented with an assortment of pictures (e.g. pencils of varying lengths) and asked to find all of the ones having a certain quality (e.g. "not long," "full," etc.) The sample consisted of 8 three-year-olds, 16 four-year-olds, 16 five-year-olds, and 32 adults. Her findings suggested generally that five-year-olds behave fairly similarly to adults and do show evidence of mitigation, while three- and four-year-olds are less sensitive to this effect. Given that the original sample of three-year-olds was much smaller than the other groups, our focus this summer was to test 8 more three-year-olds in order to strengthen Wang's conclusions.

This summer research also followed up on what I learned in Jill de Villiers' language acquisition course in the fall, now having the opportunity to see how this kind of research is actually done in the field. I learned a lot about how to successfully test young children, through both running studies, and having discussions in the lab. From how to keep experiments entertaining and enjoyable for children, to finding the just the right context to eliciting production of certain types of structures, there are many unique challenges in trying to understand children's language.

Wang, Xiaozhao (2016). Interpreting Negated Adjectives: A Developmental Perspective (Unpublished Undergraduate thesis). Smith College, Northampton, MA.

SURF 2018-Post SURF Survey

Name	Bushra Tasneem
Year of Graduation	2020

Are you in a Graduate program?	no
SURF Advisor	Tamar Friedmann, Mathematics and Statistics
Advisor Department	Mathematics and Statistics
SURF Field of Study	Optimization
Title of Abstract/Research	Constructing an Algorithm to Find an Efficient Minimum Spanning Tree in a Network

Please type your abstract below.

During this summer we were working on a network optimization problem where we transport materials. We were studying a network that contains demand nodes, supply nodes and transit nodes where there are fixed costs to build the edges and flow costs to transport materials. The objective of this network optimization problem was to minimize the cost of transportation. My research focused on a structure called EMST(Efficient Minimum Spanning Tree), which had been proposed by Prof. Friedmann and her team of student researchers. The goal of my SURF project was to find an algorithm to find an EMST or an approximation of one in such a network.

To find the algorithm for the EMST, we used the findings of the paper titled "Balancing Minimum Spanning Trees and Shortest-Path Trees" by Khuller et al, which proposed the structure of (,)-LAST(Light Approximate Shortest-path Tree). We studied the algorithm for finding the (,)-LAST. The purpose of an (,)-LAST and an EMST is similar. However, one major difference is that an (,)-LAST has a single root while EMSTs may have several roots because the roots are the supply nodes. After we studied the algorithm to find an (,)-LAST, we tried to find an algorithm initially by forming multi-rooted (,)-LASTs with different roots.

Initially, we emulated the algorithm for finding an (,)-LAST but repeated the process for two roots simultaneously but we ended up with cycles when we we were looking for trees which do not have cycles. Setting each of the node in the graph as the designated root, we found an (,)-LAST. Then, after having selected two nodes as roots, we selected the shortest path from a node to the root in the respective (,)-LAST to form a multi-rooted (,)-LAST. In this approach, we failed to contain the distances within the bounds and we ended up with cycles. We took another approach where for each demand node, we look at the edge sequence of the shortest path from the demand node to the respective roots. We looked at all of the different edge sequences of each graph to the respective nodes and decided to include the path with the maximum common edges. We constructed a multi-rooted (,)-LAST with common edges in a manner that maximizes the number of common edges; however, we also ended up with cycles with this approach.

Although one of our main objectives initially was to not include a cycle as a cycle defies the definition of an EMST. However, in all of our approaches, we ended up with cycles in our multi-rooted LASTs. Given that our objective was to minimize the cost of transportation, Prof. Friedmann suggested that cycles may, after all, reduce the overall cost of transportation. Hence, in the future, it may be explored whether an EMST can be approximated where the inclusion of a cycle minimizes the cost.

Works cited:
Tamar Friedmann, Yijia Cui, Qiaomei Li, Xuxi Ding, Chujun He, Emily Chang, " On Stacking Efficient Minimum Spanning Trees" (August 2018)
S. Khuller, B. Raghavachari, and N. Young, "Balancing minimum spanning trees and shortest-path trees" Algorithmica 14, no. 4(October 1995): 305–321

SURF 2018-Post SURF Survey

Name	Jingjie Hu
Year of Graduation	2020

Are you in a Graduate program?	no
SURF Advisor	Nathan Derr, Biological Sciences
Advisor Department	Biological Sciences
SURF Field of Study	biochemistry & biophysics
Title of Abstract/Research	Investigating the coordinated transport of synthetic spherical cargos by dynein teams

Please type your abstract below.

Cytoplasmic dynein is a microtubule-based motor protein that drives the retrograde transport of many cargos in eukaryotic cells, including vesicles, organelles, and proteins. It thus plays an essential role in maintaining the spatial and temporal distribution of various cellular components to ensure the cell's survival and functioning. Malfunctioning of dynein or its regulators can result in neurodegenerative diseases such as lissencephaly. In recent studies, in vivo evidence of dynein cooperating in teams to transport vesicles has been reported (1, 2), but the mechanism behind such coordinated transport remains to be elucidated. Rai et al. (3) showed that late phagosomes are transported by dynein clusters in the cell. Similarly, Erickson et al. (4) suggested in their in silico study that motors should cluster instead of spread randomly over the cargo surface to allow efficient regulation of transport. Both studies indicate that the geometric arrangement of dyneins on the cargo surface may be important to their transport mechanism.

In this study, we investigate the motility and dynamics of synthetic spherical cargos, which are mimics of cellular vesicles, hauled by multiple dynein motors on microtubules in vitro. The spherical cargo, approximately 80nm in diameter, is a "soccer ball (SB)" like structure folded using the DNA origami technology (5). We attach varying numbers of purified recombinant dynein to different designated positions on the spherical surface in order to study the influence of different dynein organizations on the cargo motility. While currently we can only determine the cargo's translational velocity and run length, we hope to also study its rotational dynamics in the future. The results will help us determine the characteristics and feasibility of each kind of dynein geometry and understand how this protein can work in teams to transport vesicles. Preliminary data generated from total internal reflection fluorescence (TIRF) microscopy show that the SB structures complexed with multiple dyneins move faster and further than dynein by itself. We are currently examining the differences between the following three types of dynein-SB complexes: those with three dyneins in one cluster, ten dyneins along the equator, and 30 dyneins covering the entire surface. More SB designs with varying cluster densities will soon be generated and tested.

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1. B. H. Blehm et al., PNAS 110, 3381 (2012).
2. A. K. Rai et al., Cell 152, 172 (2013).
3. A. Rai et al., Cell 164, 722 (2016).
4. R. P. Erickson et al., PLoS Comput Biol 7, e1002032 (2011).
5. P. W. K. Rothemund, Nature 440, 297 (2006).

SURF 2018-Post SURF Survey

Name	Claire Park
Year of Graduation	2021

Are you in a Graduate program?	no
SURF Advisor	Nathan Derr, Biological Sciences
Advisor Department	Biological Sciences
SURF Field of Study	Biophysics
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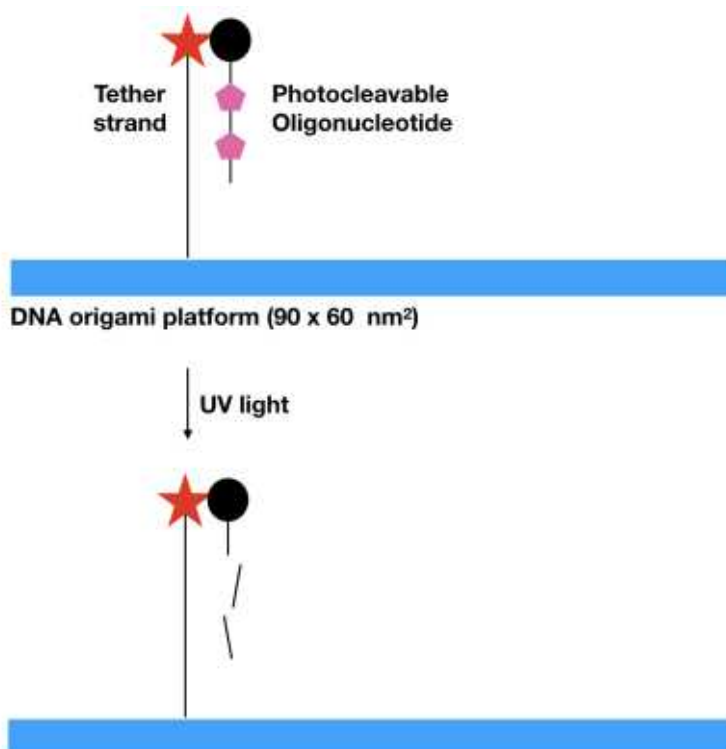
Screen Shot 2018-09-05 at 11.34.38 PM.png

Title of Abstract/Research	Observing Photocleavable Linkers in Oligonucleotides on DNA Origami Platforms

Please type your abstract below.

DNA base pairs are specific and predictable, which enable researchers to engineer dynamic nanostructures in the laboratory. Namely, the DNA origami method harnesses these properties for the programmable construction of diverse 3D nanostructures. This technique relies on a long, single-stranded DNA "scaffold" that is pinched into the final shape by numerous short, single-stranded DNA "staples". Using this method, we created a functionalized DNA origami platform to observe dynamic events of photocleavable linkers in the presence of UV light in the TIRF (Total Internal Reflection Fluorescence) microscope.

The design of the origami platform is necessary since we can take advantage of over 170 different addressable locations to add functional features. One essential component of the nanostructure is a single-stranded "tether" extending from the platform that is complementary to the photocleavable oligonucleotide strand. Oligonucleotides are short, single-stranded sequences of DNA that can be modified. For our photocleavable strand, we inserted a photocleavable linker at every 7 bases of a 21 base-long oligonucleotide. Accordingly, this allows for efficient cleavage when UV light is present, granted that DNA dissociates at a rate dependent on the length and sequence of bases.

Furthermore, to ensure that these modifications did not fully disrupt the hybridization of the tether strand on the platform to the photocleavable oligonucleotide, we ran a high-resolution melt curve assay. A melt curve experiment reveals the temperature at which a double-stranded DNA complex is 50% dissociated. This demonstrated that our modified strands still melted like unaltered DNA, albeit at a slightly lower temperature.

In the future, we hope to determine the best operating conditions of this system and apply this dynamic nanoscale technology to motor proteins, such as dynein, to control cargo switching.

SURF 2018-Post SURF Survey

Name	Ojaswi Aryal **Smith**
Year of Graduation	2020

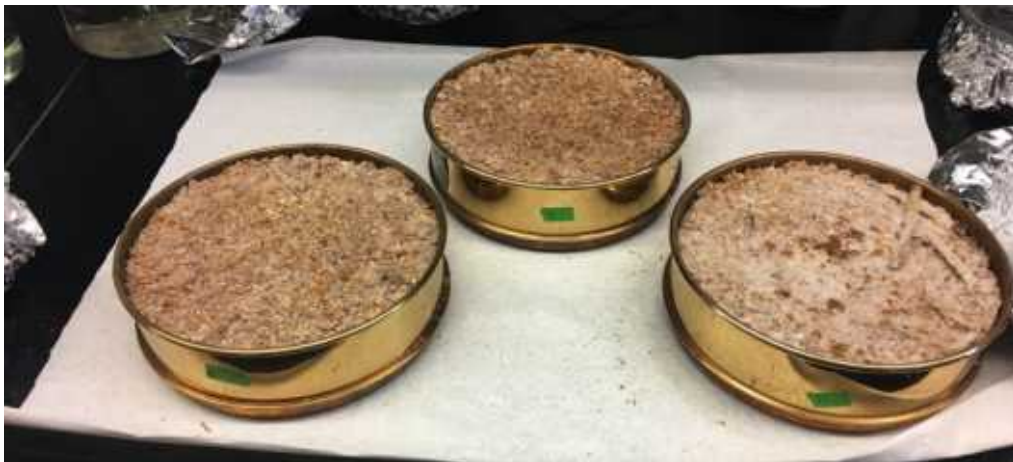|	
Are you in a Graduate program?	no
SURF Advisor	Niveen Ismail, Engineering
Advisor Department	Engineering
SURF Field of Study	Using Natural Systems to Improve Water Quality
Please list co-authors of your abstract	Tijana Cooley

Upload image(s) in .png format; 1,100 MB max size each

oaryal17.png

Title of Abstract/Research	Use of Fungi for Removal of Escherichia coli

Please type your abstract below.

The degradation of clean freshwater sources due to microbial pollutants has adverse effects on humans and environmental systems. New approaches for effective removal of these pollutants are needed to address this growing issue. The United States Environmental Protection Agency (USEPA) lists fecal indicator bacteria (FIB) as the leading cause of the impairment of water bodies (1), and an example of such an FIB is Escherichia coli, found in freshwater. Some studies have suggested that the use of fungi may be effective in removing E. Coli from water through the process of mycofiltration (2). Our research investigated the interaction between E. coli and the fungi Pleurotus Ostreatus (oyster mushrooms). We also explored different procedures and experimental setups to test the feasibility of using fungi to remove E. coli.

We investigated the ability of fungi to remove E.coli with two systems; batch and flow through. We conducted batch experiments by placing bottles containing fungi and E. coli spiked water on a shaker for the duration of the experiment, varying the amount of fungi in contact with the water. Flow-through experiments consisting of multiple recirculations of E. coli spiked water through sieves of packed fungi were set up as shown in Figure 1. While the results from batch procedure did not show significant removal of E.coli, the flow-through experimentation generated data showing approximately 1 log removal. The results suggest that a fungi system may be effective in E. coli removal and that the interaction of fungi and water of the flow-through system is more effective that a batch system. Future research includes developing a more rigorous and reliable flow-through design and testing different parameters to ultimately create a bioretention system able to treat runoff.

Figure 1: Sieves C, B and D from left to right packed with fungi and sawdust, B was pre-soaked.

1. U.S. EPA. Recreational Water Quality Criteria. Rep. no. EPA-820-R-14-011. U.S. Environmental Protection Agency - Office of Water, 2012. Web.
2. Taylor, Alex, et al. "Removal of Escherichia coli from synthetic stormwater using mycofiltration." Ecological engineering 78 (2015): 79-86.

SURF 2018-Post SURF Survey

Name	Joyce Lee
Year of Graduation	2020

Are you in a Graduate program?	no
SURF Advisor	David Gorin, Chemistry
Advisor Department	Chemistry
SURF Field of Study	Chemistry
Title of Abstract/Research	Chan-Lam Copper-Mediated Oxidative Cross Coupling of Phenols with Methylboronic Acid

Please type your abstract below.

O-methylation is common in natural product synthesis and medicinal chemistry. However, these reactions are often performed with hazardous electrophilic methylation agents, such as diazomethane, dimethyl sulfate, and methyl iodide. Although effective, these reagents are either unstable or toxic, triggering the need to develop a safer, regioselective methylation reagent. One strategy we focused on is using nucleophilic methyl sources that are safer to handle.

The Chan-Lam reaction, the Cu-catalyzed oxidative coupling of heteroatom nucleophiles with arylboronic acids, suggested a potential strategy to oxidatively cross-couple phenols with methylboronic acid. After screening previously successful conditions of Chan-Lam N-alkylations, we developed a new Chan-Lam conditions for the methylation of phenols with methylboronic acid, with isolated yields as high as 89% on 4-fluorophenol.

Research this summer focused on expanding the existing substrate scope proposed by Mairead Bartlett '18. I mainly probed substrates with electron donating groups that proved to be the hardest to undergo conversion. When increasing temperature and/or copper equivalents had no effect, I tried additional strategies, such as using TEMPO as a co-oxidant or trying different ligands to further encourage conversion. Interestingly, homocoupling of starting materials as a side process was observed for some substrates with electron donating groups, such as 4-tert-butylphenol and 4-ethylphenol.

Further study will be done to gather more insight on the effect of TEMPO and using different ligands in the methylation of phenols during the upcoming school year.

SURF 2018-Post SURF Survey

Name	Ziqian Su
Year of Graduation	2020

Are you in a Graduate program?	no
SURF Advisor	Kevin Shea, Chemistry
Advisor Department	Chemistry
SURF Field of Study	Chemistry
Upload image(s) in .png format; 1,100 MB max size each
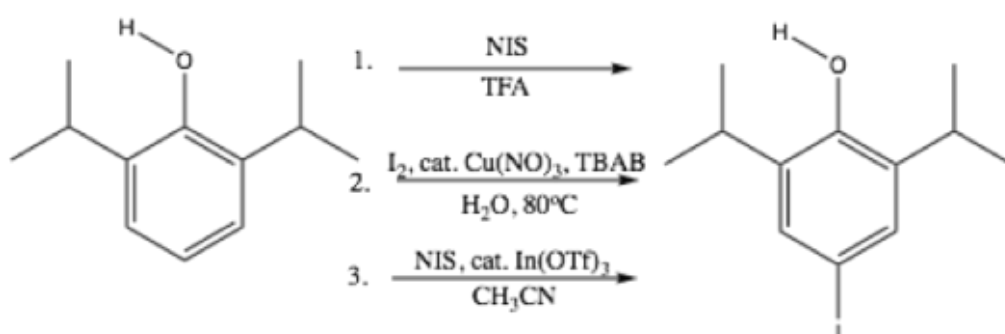
图片 1.png |
| **Title of Abstract/Research** | Synthesis of para-Substituted Propofol Derivatives |

Please type your abstract below.

Propofol is a widely-used anesthetic during surgery and other medical procedures, but it is also known for causing side effects that can sometimes be severe[1]. In order to find a novel anesthetic with fewer side effects, we worked with Professor Hall to select potentially effective compounds. We proposed pathways to synthesize the propofol derivatives of interest for further testing. Specifically, after the separation of the stereoisomers of 2,6-di-sec-butylphenol by flash column chromatography was unsuccessful, we shifted our interest to synthesize para-substituted propofol derivatives. Trapani[2] proposed that derivatives with electron-withdrawing para-substituents are more likely to be effective anesthetics. We further propose that propofol derivatives that are more likely to be active anesthetics are those with para-substituents that have positive sigma values (which indicates that the substituent can contribute toward the deprotonation of propofol) as well as the ability to cause the substituted propofol to have a higher pKa value, such as 4-fluoropropofol and 4-benzamidepropofol. The goal for this summer was to develop synthetic pathways and separation methods that can optimize the production of these two compounds.

Research this summer mainly focused on the iodination of 2,6-diisopropylphenol (propofol), which was the first step of the proposed three-step synthesis of 4-benzamidepropofol. Three methods were tested to optimize this iodination step (Figure 1). For the first method, the reaction produced side products such as the tri-substituted and di-substituted iodopropofol that were very hard to separate from the desired product. The second method led to more than six impurities in the flask and only trace amount of product was identified according to the reference spectra. The third method was the most promising, though it took the 22 hours to complete. It only produced one side product that can be separated from the desired product by flash column chromatography, which gave pure product in very low percent yield (8%-15%). The pure product was used for a cyanation reaction for the second step, and the results were not fully analyzed yet. Future work on this project includes modifying the solvent system of the column to successfully purify more product to improve the percent yield as well as continuing on performing trials on the next cyanation step. I will continue the work on this three-step synthesis as my special studies project in the upcoming school year.

Reference
1) Miner, JR. Annals of Emergency Medicine. 2007, 50, 182-187
2) Trapani, G. J. Med. Chem. 1998, 41, 1846-1854

SURF 2018-Post SURF Survey

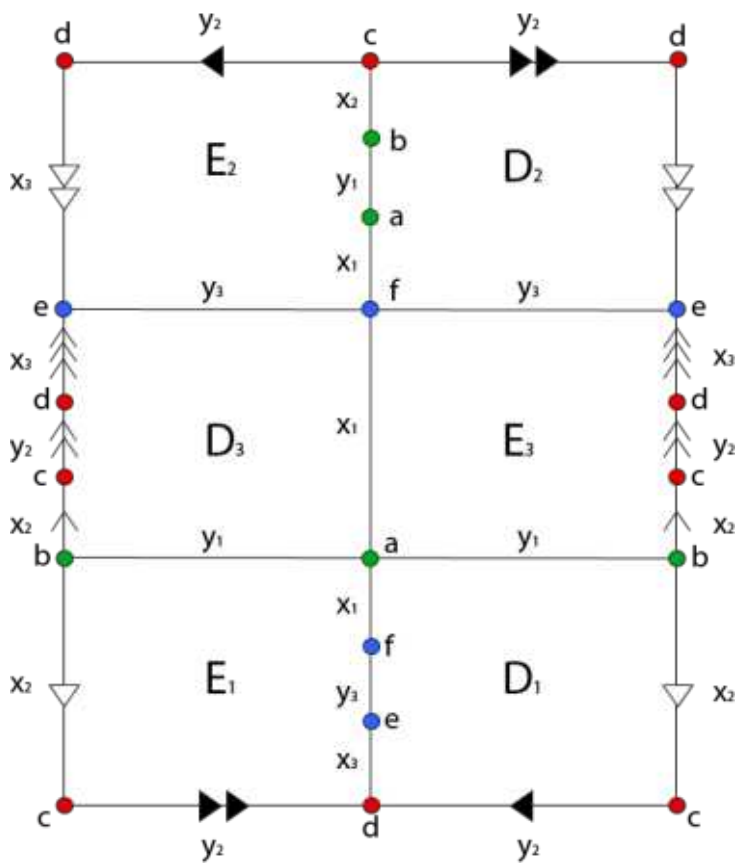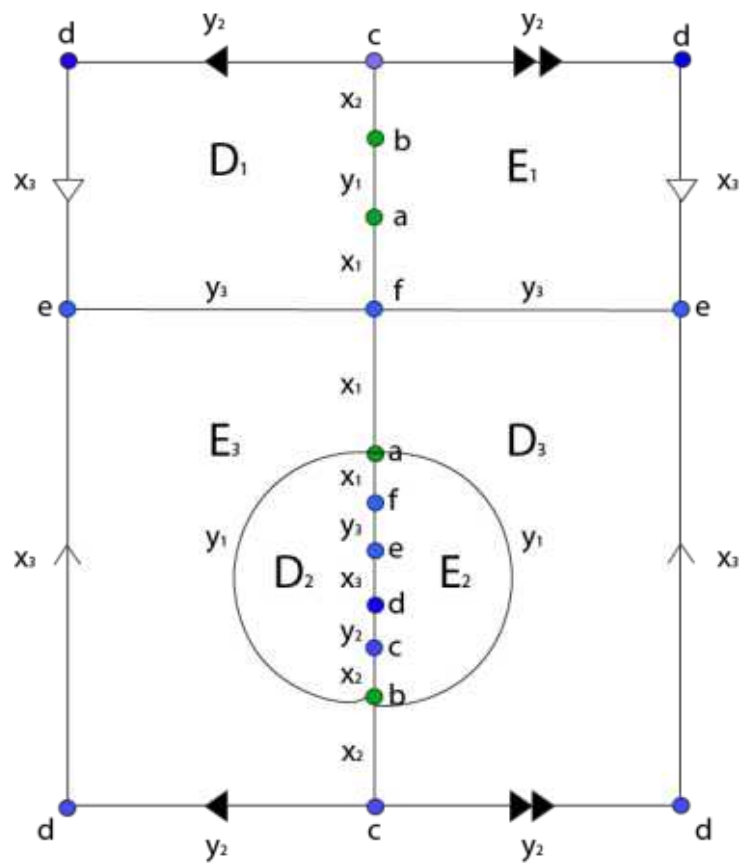|	
Name	Mariya Germash
Year of Graduation	2019
Are you in a Graduate program?	no
SURF Advisor	Non-Smith Advisor
If your SURF Advisor was not listed above you can enter their name here.	Patricia Cahn
Advisor Department	Mathematics and Statistics
SURF Field of Study	Knot Theory

Upload image(s) in .png format; 1,100 MB max size each

M Germash 1.png

M Germash 2.png

Title of Abstract/Research	Linking Numbers and 3-Fold Dihedral Covering Spaces of 3 Bridge Knots
Please type your abstract below.	Knot theory has implications in applied science as well as various pure mathematical fields. In particular, knots can be used as a mathematical tool to study topological spaces. One simple class of knots that researchers commonly study are three-bridge knots. In this project we focus on finding the 3-fold irregular dihedral covering spaces of three bridge knots, and drawing connections from those spaces to the knot's dihedral linking number. This project is a continuation of research conducted by a group of students under the supervision of Professor Patricia Cahn in Spring 2018. We focused first on finding the covering spaces of three bridge pretzel knots. Previous results have shown that the 3-fold irregular dihedral covering space of any three bridge knot is an L(p,q) lens space1, and that the covering space of a three bridge pretzel knot is an L(p,1) lens space.2 To find these covering spaces, we drew the 3-colored knot in bridge position with bridge sphere S2, then found the shadows of the knot and lifted them to the three-fold dihedral cover of the bridge sphere. The result is a Heegaard diagram for the resulting three-manifold. We have found a simple algorithm to find the shadows of any pretzel knot. (See Figures 1 and 2 for the diagrams of the two tori that arise as dihedral covers of the bridge sphere.) In particular, we created a spreadsheet of some simple pretzel knots with their dihedral linking numbers and covering spaces. We found a pattern between linking numbers and covering spaces. Further research can expand upon this pattern by studying the covering spaces of non-pretzel three bridge knots, and further exploring the methods to simplify finding the shadows of a knot. [1] Uchida, Y. "On three-fold irregular branched coverings over closed three-braid and three-bridge knots." Topology and its Applications. 146-147 (2005) 189-194. [2] Hosokawa, F. and Nakanishi, Y. "On 3-Fold Irregular Branched Covering Spaces of Pretzel Knots." Osaka J. Math. 23 (1986), 249-254.

SURF 2018-Post SURF Survey

Name	Breanna Parker
Year of Graduation	2018

Are you in a Graduate program?	no
SURF Advisor	Non-Smith Advisor
If your SURF Advisor was not listed above you can enter their name here.	Dr. Alex Barron
Advisor Department	Environmental Science and Policy
SURF Field of Study	Environmental Economics
Upload image(s) in .png format; 1,100 MB max size each	carbon price dollars.png
Title of Abstract/Research	Proxy Carbon Price Strategy For Smith College

Please type your abstract below.

This Summer Undergraduate Research Experience advanced three primary tracts of research and development on the complex and urgent problem of climate change: 1) Write a paper for peer-reviewed publication on carbon price strategies, 2) contribute to the Internal Carbon Price Higher Education Working Group and 3) experiment with a proxy carbon price in capital planning at Smith College. This research built upon the 2018 honors thesis "Designing a Proxy Carbon Price Strategy for Smith College," emphasizing experimentation on the pilot project to evaluate capital purchasing decisions for Washburn House (Parker, 2018).

The paper for peer-review publication focused on the need for carbon pricing in the third sector and describes tradeoffs among the three primary carbon pricing models: proxy carbon pricing, carbon charge, and carbon fund. The Internal Carbon Price Higher Education Working Group developed an online toolkit of resources for higher education institutions to implement internal carbon pricing strategies. This toolkit will be available on Second Nature and will be launched at the Global Climate Action Summit in September of 2018. These publications communicate key findings on the developing field of internal carbon pricing, which address the problem of incorrect price signals for carbon emissions that contribute to climate change and social costs.

Experimentation with the proxy carbon price strategy at Smith College was advanced through the pilot project on Washburn House. A detailed analysis of five energy efficiency retrofit options was completed using the Lifecycle Cost method with a proxy carbon price. This analysis identified the cost- and carbon-saving options for renovating the residential house. The next steps for this research are to experiment more pilot projects in capital planning and improve the accuracy of the Lifecycle Cost method with a proxy carbon price for the specifications of the Combined Heat and Power Plant at Smith College through thesis research.

SURF 2018-Post SURF Survey

Name	Serena Hansraj
Year of Graduation	2019

Are you in a Graduate program?	no
SURF Advisor	Non-Smith Advisor
If your SURF Advisor was not listed above you can enter their name here.	Joseph O'Rourke
Secondary SURF Advisor	Gaby Immerman
Advisor Department	Computer Science
SURF Field of Study	Computer Science
Title of Abstract/Research	Automation of the Smith College Botanic Garden

Please type your abstract below.

This research was about how to automate simple tasks for the programs used in the Botanic Garden, such as ArcGIS Pro, and how to create workflows for reports. The first task requires that data in the Microsoft SQL server must be taken into ArcGIS Pro or ArcMap and then create a shapefile using a python script. The next steps of this process would include the implementation of a collector app which will input data directly into ArcGIS Online; therefore, it would require that the SQL server will need to be updated as well. This would require a separate script. To do this, ArcGIS Pro has packages for Conda, a environmental manager that can setup the python environment that ArcGIS provides. ESRI training was provided for learning the basics for geodatabases and gis. For the second part of the project, the botanic garden needed an automated report workflow for the people counter installed in Lyman Conservatory. I reached methods recommended by the FTP service WinSCP, a service which would create a remote connection to the server hosting the people counter data and download the files that are formatted with recordings for 15 minutes intervals of people entering and leaving. To automate this part, it was broken into three parts of: the download, the statistics, and the report. The best solution was to use task scheduler to open the program and run specific argument to do a FTP download. Then the scheduler should open excel to run a premade macro to generate the statistic needed or reformat for easy of creating a report. The last step was to then upload the new data to a live report that will automatically update averages and graphs. While the first two steps were done using task scheduler, the last step was left up to staff for them to find which services would provide the better solution from the ones found.

SURF 2018-Post SURF Survey

Name	Desislava Stoyanova
Year of Graduation	2019

Are you in a Graduate program?	no
SURF Advisor	Sarah Moore, Engineering
Advisor Department	Engineering
SURF Field of Study	Targeted cancer therapy
Title of Abstract/Research	Engineering proteins for diagnostics and treatment of human cancers
Please type your abstract below.	Most conventional cancer therapies focus on non-selective killing of rapidly dividing cancer cells. As a consequence, many healthy cells that naturally divide at a faster rate are severely affected by the treatment which causes numerous side effects for the patients. Thus, there is a sustained effort to develop targeted cancer therapy that would minimize the side effects and result in more effective treatment. Mesothelin (MSLN) is a cell surface protein, overexpressed on the surface of a number of cancers and correlating with an increased tumor invasiveness and poor prognosis. MSLN has potential as a novel biomarker for diagnostics and therapy. Moreover, the interaction of MSLN with another tumor biomarker, MUC16, is suggested to promote tumor metastasis and migration, so an inhibition of the MSLN-MUC16 interaction process could also have a direct therapeutic effect. The goal of the Moore lab is to engineer MSLN-targeting proteins that could serve as theranostics, or both as a targeted therapeutic and molecular diagnostic. So far, previous members of the lab have identified engineered protein candidates that show promising initial indication to be internalized by and cytotoxic to the cancer cells. This summer, I worked with the engineered proteins that bind mesothelin that are the current lead candidates for use as therapeutics. My project was focused on characterizing how the binding of the proteins to MSLN affects cell migration and metastasis. I was also interested in exploring how introducing treatment to the cells affects the interaction between MSLN and MUC16 and whether that influences cell migration and adhesion. I am currently working on further developing the protocols that I have designed and on collecting more data for analysis. I am hoping to be able to continue working on this project for my senior honors thesis next year.

SURF 2018-Post SURF Survey

Name	Léo Young
Year of Graduation	2020
Are you in a Graduate program?	no
SURF Advisor	David Gorin, Chemistry
Advisor Department	Chemistry
SURF Field of Study	Bio-Organic Chemistry
Title of Abstract/Research	A DNA-Catalyst Enzyme Mimic for Site Selective Chemistry in Biological Systems
Please type your abstract below.	Performing useful site selective chemistry in biological systems has always been a challenge for scientists. Reactions can easily be performed to change just one kind of functional group, but not so much for just one instance of the functional group. DNA catalyst conjugates, or DCats, were designed to provide site-selectivity by linking a DNA aptamer, which has high binding affinity to the target molecule, to a small molecule catalyst. Both the DNA aptamer and the catalyst are interchangeable in order to perform different reactions on different targets. We hypothesize that the DNA aptamer binds the target while holding the catalyst in close proximity in order to increase effective concentration. My research aims to use more nucleophilic catalysts with the hopes that they increase reaction rate. This summer, I synthesized DCats with thiol (-SH) and 4-dimethylaminopyridine (DMAP) catalysts and cholic acid DNA aptamers. I began to compile a full library of these types of DCats in order to determine which position on the aptamer optimizes the catalytic activity. Only preliminary data has been collected on these catalysts. Looking forward, I will be optimizing these catalysts as well as synthesizing DCats with two catalysts linked to the DNA aptamer.

SURF 2018-Post SURF Survey

Name	DUANYUE YUN
Year of Graduation	2019
Are you in a Graduate program?	no
SURF Advisor	Julianna Tymoczko, Mathematics and Statistics
Advisor Department	Mathematics and Statistics
SURF Field of Study	Splines
Title of Abstract/Research	Polynomial Splines on Cycles

Please type your abstract below.

Given a graph with fixed edge labels, a spline is a set of vertex labels such that the labels of any two adjacent vertices are congruent modulo the edge label between them. This project studies cycles with polynomial edge labels in the form of $(y+mx+b)^d$ where m and b are real non-zero constants. The main objective is to generate a basis for the splines and therefore determine the degree sequence.

When the cycle has one identical edge label E, there exists a flow-up basis. Besides the trivial spline, there are (n-1) columns where the ith entry is E and all other entries are zero. Therefore, the degree sequence is (1, 0, ..., 0, n-1) with (n-1) being the dth entry. This also applies to cycles with one identical edge label in the form of $(y+mx)^d$.

When the cycle has two distinct edge labels E_1 and E_2, there is an algorithm to generate a flow-up basis. The basis consists of the trivial spline, (n-2) columns whose non-zero entries are either E_1 or E_2 and one column that has one non-zero entry E_1E_2. With this, the degree sequence is (1, 0, ..., 0, n-2, 0, ..., 0, 1) with (n-2) being the dth entry and the second "1" being the 2dth entry.

When the cycle has three distinct edge labels E_1, E_2 and E_3, the basis depends on the geometric positions of the lines represented by the edge labels ignoring the power raised. Here 3-cycles with degree one edge labels are extensively studied. In this case, it is proved that a degree one spline generator exists only when the three lines are parallel or intersect at one unique point. Hence, the resulting degree sequence is (1, 1, 1). When the three lines intersect at more than one point, only degree two spline generators are possible. The corresponding degree sequence is (1, 0, 2). Data is collected for higher degrees. When the three lines are parallel or intersect at one point, the degree sequence follows a fixed pattern depending on whether d is even or odd. When the three lines intersect at more than one points, the degree sequence is (1, 0, ..., 0, 3) with 3 being the 2dth entry. Furthermore, data suggests that given the value of d, the degree sequence of n-cycle remains the same once the number of lines reaches d+1. Mathematical proof on these two findings requires further work.

SURF 2018-Post SURF Survey

Name	Blanca Martin Burgos
Year of Graduation	2020
Are you in a Graduate program?	no
SURF Advisor	Mary Harrington, Neuroscience
Advisor Department	Neuroscience
SURF Field of Study	Neuroscience
Upload image(s) in .png format; 1,100 MB max size each	
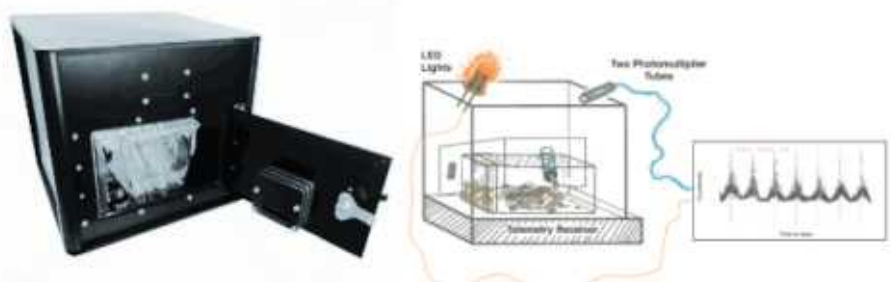
Figure1. In vivo bioluminescence imaging equipment

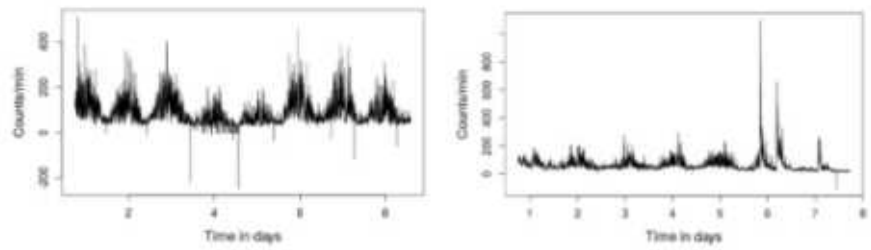SURF Image 1 B Martin Burgos.png

Figure 2. Bioluminescence in two VB control mice

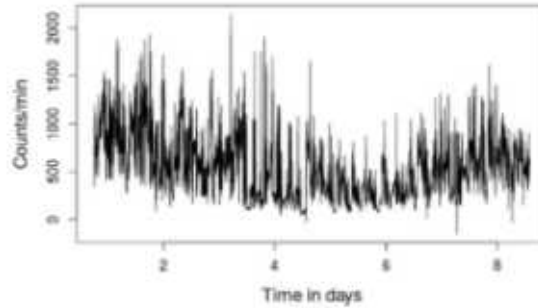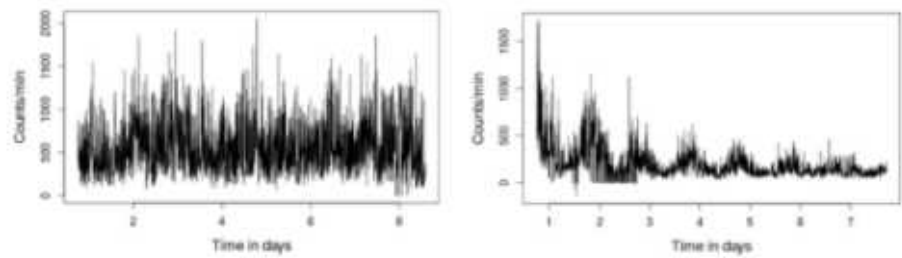Figure 3. Bioluminescence in Bmal KO mouse

Figure 4. Bioluminescence in two VB KO mice

SURF Image 2 B Martin Burgos..png

Title of Abstract/Research — Measuring circadian bioluminescence from in vivo mice with genetically engineered defects that alter circadian behavior

Please type your abstract below.

Circadian (approximately 24 h) rhythms play a key role in human behavior and physiology, Circadian disruption impacts cognitive, metabolic and cardiovascular health by affecting interactions between peripheral and central clocks. To study dynamics at a system level, methods to measure circadian rhythms of peripheral clocks in intact animals are required. Our lab has developed a method to measure bioluminescence from tissues of freely moving mice. This non-invasive in vivo method uses equipment designed by David Ferster (Actimetrics). The equipment used has two photomultiplier tubes positioned above the mouse cage, housed within a light-tight box, that reads off bioluminescence (Figure 1). In an ongoing study that will be continued into the fall, we will use the in vivo imaging technique developed by the lab to monitor the levels of bioluminescence in control mice (VB control and Bmal wild type) and mice with genetically engineered defects that alter circadian behavior (VB knockout mice and Bmal knockout mice). In Bmal knockout mice, the Bmal gene is deleted in all cells of the body. In VB knockout mice, Bmal is floxed using the Vgat Cre system, which targets GABA cells (Vgat is is involved in the uptake of GABA and glycine into the synaptic vesicles). All cells in the Suprachiasmatic Nucleus (SCN) are GABAergic, thus, Bmal is deleted in the SCN and other GABAergic cells of VB knockout mice. Bmal is a core clock gene that plays a key role in transcriptional-translational loops that are responsible for generating molecular circadian rhythms. Hence, by studying and comparing the bioluminescence of VB control, Bmal wild type, Bmal knockout, and VB knockout mice, we are hoping to further our understanding of the effect that these genetic defects have on circadian behavior.

Motion actograms are recorded previous to the in vivo bioluminescence tests to collect data about the circadian activity behavior of the different genotypes.

Then, week-long bioluminescence recordings are acquired using CycLuc1 (25 mM) in 14-day osmotic mini pumps.

From our preliminary results, we can determine that VB control mice show bioluminescence rhythmicity (Figure 2) and Bmal KO mice show very arrhythmic bioluminescence levels (Figure 3). Preliminary results for VB KO mice were inconclusive(Figure 4). This experiment will be continued into the fall to confirm and develop the results obtained during the summer.

SURF 2018-Post SURF Survey

Name	Martyna Laszcz
Year of Graduation	2018

Are you in a Graduate program?	no
SURF Advisor	Non-Smith Advisor
If your SURF Advisor was not listed above you can enter their name here.	Courtney Lannert
Advisor Department	Physics
SURF Field of Study	Physics

Upload image(s) in .png format; 1,100 MB max size each	

Figure 1: Example of one of the shells observed
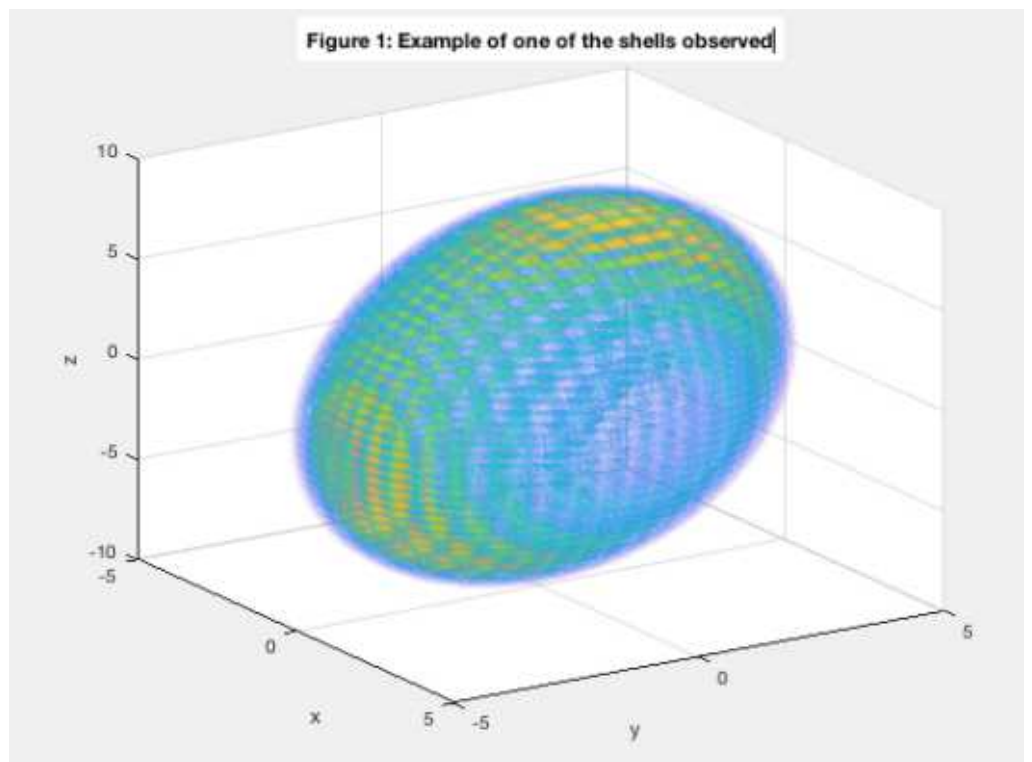
MLaszcz Abstract 1.png

Figure 2: Stills from a time evolution movie file.

MLaszcz Abstract Figure 2.png |
| **Title of Abstract/Research** | Measurement and analysis of ground state density of Bose-Einstein Condensate hollow shells |

Please type your abstract below.

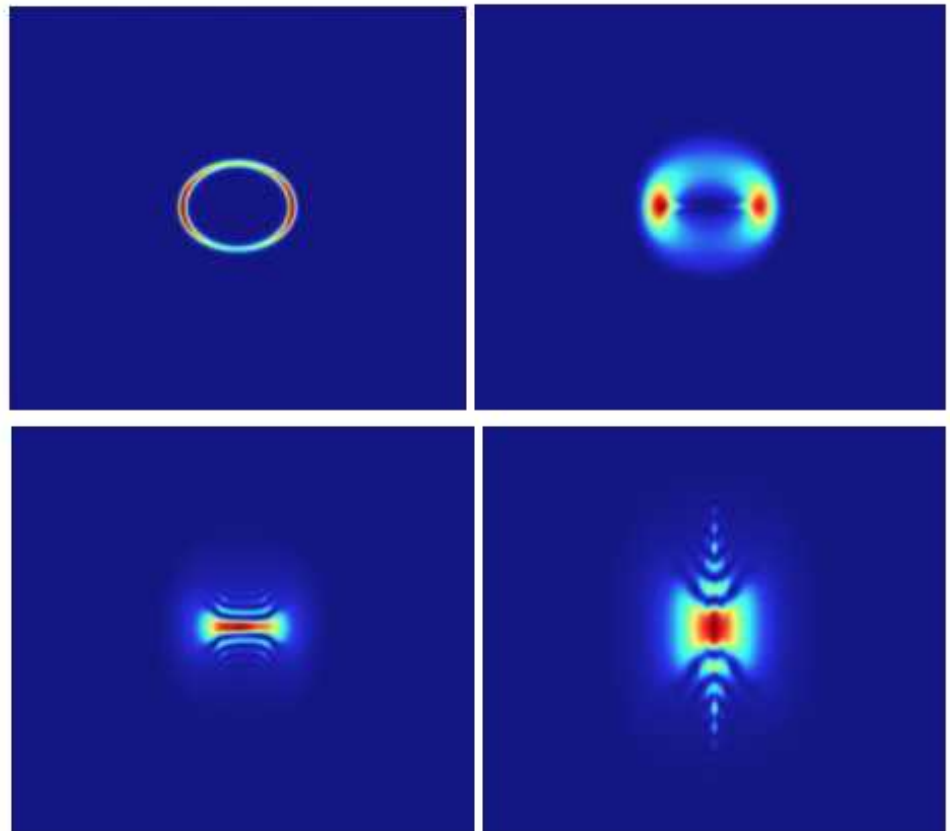This summer, we have been working with different kinds of simulated visualizations, using MATLAB's surface plot and slice plot features, of the ground state atom density in a replica Bose-Einstein Condensate (BEC) trap that will be sent up with NASA's Cold Atom Lab (CAL). We are looking at hollow shells of BEC's, of which the particles are in the lowest quantum state; visualizations of these "shells" allows us to better understand what they look like within the traps in order to change various parameters of the experiment. In the data used, the shape of the shell is a "skin" of particles in a tilted, oblong configuration, in which the "skin" gets thicker and slightly more rounded as it gets smaller.

Because our work was focused on visualizing the shape and size of the shell, our goals changed as the weeks went on. We began with trying to accurately visualize and measure the bubble on its' natural axes. The bubble has about a 44 degree tilt downward on the y-axis, measured by taking distance measurements in the y-z plane on multiple different ground states and averaging them. The method to measure the bubble's lengths was to take slices on its' natural, tilted axes and use the 3D distance formula at points away from the origin.

Once measurements were taken and we were confident in them, we moved into studying freely expanded ground states over time, in hopes of extracting interference patterns. To begin this process, we had to pad the ground state density with empty space (values of zero) so it has somewhere to go during free expansion. Then we would run the padded ground state density through a script that took every particle's position in time over 1.5 seconds, in pieces over 2D planes. The end result of these time evolutions were movie files that can be looked at frame by frame to further study. This project is currently ongoing and the movies of the time evolved ground state densities will be used by the members of the research group and students who assist.

SURF 2018-Post SURF Survey

Name	Eleanor Goetz
Year of Graduation	2019

Are you in a Graduate program?	no
SURF Advisor	Laura Katz, Biological Sciences
Advisor Department	Biological Sciences
SURF Field of Study	Biology
Title of Abstract/Research	Genome Dynamics and Nuclear Changes throughout the Foram Life-cycle

Please type your abstract below.

Foraminifera are important indicators for understanding the relationship between the climate and ocean life. Most taxa build shells, called tests out of calcium carbonate, making these organisms important for the carbon burial process (the conversion of atmospheric carbon to calcium carbonate) (Findlay et al., 2015). They are best known in the paleontology field because their fossilized tests can be used to date sediment and rock, which is helpful in studying past climate events and sourcing petroleum (Grell, 1973). Additionally, living foraminifera can give us insights into the effects of present water temperature and quality on marine, calcifying organisms.

This summer I continued researching foraminiferan life cycles. Many foraminifera go through an alternation of sexual and asexual generations, which may correspond to changes in nuclear number and test morphology. For my project I chose to focus on the genus Ammonia because the initial chamber, called the proloculus changes with the life cycle stage, allowing for easy identification. Those that go through asexual reproduction have a significantly larger proloculus than those that go through gametogenesis (Goldstein et al., 1993). These life cycle stages were investigated using by microscopy and molecular techniques. Using DAPI, the nuclei of individual cells may be imaged using the Leica confocal microscope. Different fixatives and decalcification steps were tested in an attempt to image through the test. Molecular techniques included the sequencing and analysis of whole genome amplifications (WGAs) and whole transcriptome amplifications (WTAs). The continuation of this analysis was conducted this summer using the Katzlab phylogenomic pipeline (Grant et al, 2014). Future steps for this project include improving image quality of DAPI staining and analysis of whole genomes and transcriptomes.

Findlay, H., Gibson, G., Kędra, M., Morata, N., Orchowska, M., Pavlov, A. K., … Logvinova, C.(2015). Responses in Arctic marine carbon cycle processes: Conceptual scenarios and implications for ecosystem function. Polar Research, 34, 24252.

Goldstein, Susan & Moodley, Leon. (1993). Gametogenesis and the Life-Cycle of the Foraminifer Ammonia-Beccarii (Linne) Forma Tepida (Cushman). Journal of Foraminiferal Research. 23. 213-220. 10.2113/gsjfr.23.4.213.

Grant, J. R., & Katz, L. A. (2014). Building a Phylogenomic Pipeline for the Eukaryotic Tree of Life - Addressing Deep Phylogenies with Genome-Scale Data. PLoS Currents.

Grell, K. G. 1973. Protozoology. 1 st edition. Berlin, Springer-Verlag

SURF 2018-Post SURF Survey

Name	Grace Mills
Year of Graduation	2019
Are you in a Graduate program?	no
SURF Advisor	Christine White-Ziegler, Biological Sciences
Advisor Department	Biological Sciences
SURF Field of Study	Biology
Upload image(s) in .png format; 1,100 MB max size each	FigureOne.png
Title of Abstract/Research	Investigation of the host colonization-related iron homeostasis genes in commensal and pathogenic Escherichia Coli
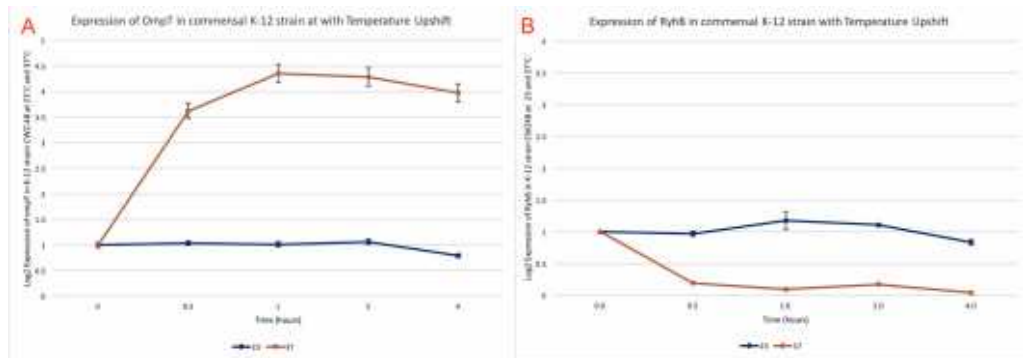
| **Please type your abstract below.** | In any given year, urinary tract infections will affect 10% of women, cost the United States approximately 1.6 billion USD, and cause 200,000 deaths worldwide (1). Additionally, enteropathogenic E. coli (EPEC) are a major cause of gastrointestinal illness and mortality worldwide (2). Like other bacteria, E. coli strains have been shown to sense a shift from room temperature (~23°C) to human body temperature (37°C) and respond by upregulating genes associated with host colonization.

Iron regulation genes are key temperature-regulated virulence factors (3). Iron is crucial to metabolism and genome maintenance pathways, but too much in a cell produces reactive oxygen species. In E. Coli, the small regulatory RNA ryhB is a key regulator of iron homeostasis. Activated under iron-poor conditions, ryhB binds DNA to promote expression of iron import proteins and mRNAs, and interacts with cleavage protein RNase E to both protect iron import proteins and encourage the degradation of iron utilization proteins. My project aimed to elucidate ryhB's role in the temperature regulation of its target genes through evaluation of ryhB levels in K-12 commensal and uropathogenic E. Coli (UPEC) strains and comparison with to EPEC strain data under aerobic as well as anaerobic conditions.

To determine ryhB levels at various time points after colonization, a growth experiment was performed with wild type K-12 and UPEC strains. Cells were grown at 23°C, shifted to 37°C, then harvested for isolation. A significant amount of time was given to learning and developing the RNA isolation technique and utilizing it on a large array of samples so as to streamline the analysis stage. Once lack of contamination was confirmed and total RNA equalized per sample via Qubit and NanoSpec respectively, target gene expression was analyzed via quantitative Reverse Transcriptase Polymerase Chain Reaction (qRT-PCR). QRT-PCR was performed first for the temperature regulated, full length gene ompT, an outer membrane aspartyl protease, to serve as a control for the integrity of the RNA (Figure 1A). Subsequently, the sRNA ryhB was tested.

Results indicated that ryhB in wild type, commensal K-12 strain exhibits a similar repression pattern to that shown in EPEC strains as part of a 2017-2018 Honors Thesis (4). EPEC strains showed a 2-fold change in ryhB following the temperature upshift, while my results generated an 5-fold change at 30 minutes post-shift which held relatively steady through 4 hours (Figure 1B). Analysis on UPEC strain is as of yet inconclusive. This project will continue as a special studies in the fall, and future directions include (a) re-isolation of and qRT-PCR analysis on uropathogenic strains, and (b) analysis of the expression change with temperature change in low oxygen versus our typical aerobic experimental conditions.

References
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2. Schmidt MA. LEEways: tales of EPEC, ATEC and EHEC. Cell Microbiol. 2010; 12(11): 1544-1552.
3. White-Ziegler CA, Malhowski AJ, Young S. Human Body Temperature (37°C) Increases the Expression of Iron,Carbohydrate, and Amino Acid Utilization Genes in Escherichia coli K-12. J. Bacteriol. 2007; 189(15): 5429-5440.
4. Van, Nhi. Gene regulation in enteropathogenic Escherichia coli. Smith College, 2018.

Figure: Expression of (A) ompT and (B) ryhB following temperature upshift (orange), versus 23°C control (blue). |

SURF 2018-Post SURF Survey

Name	Ruoqi Zhang **Smith**
Year of Graduation	2020

Are you in a Graduate program?	no
SURF Advisor	Non-Smith Advisor
If your SURF Advisor was not listed above you can enter their name here.	Rajan Mehta
Advisor Department	Mathematics and Statistics
SURF Field of Study	Mathematics
Upload image(s) in .png format; 1,100 MB max size each	

cup ϵ cap η pair of pants δ reverse pair of pants μ
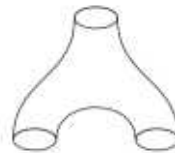
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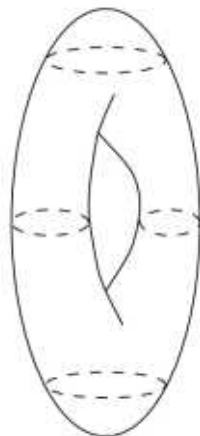
rzhang_Figure_2.png
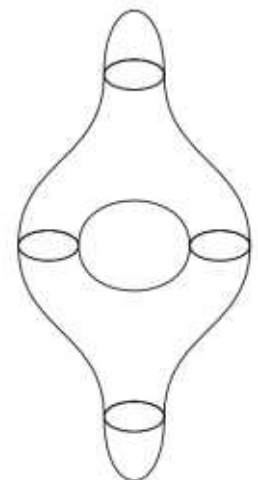
Title of Abstract/Research	Topological quantum field theories in the category of relations

Please type your abstract below.

Topological Quantum Field Theory is an area of topology where surfaces are studied by cutting them apart into simple pieces and remembering how those pieces connect to each other. This information is then converted into algebraic information that can be used to compute information about the surface. The basic building blocks are "cup", "cap", "pair of pants", and "reverse pair of pants" (with the in-boundary(ies) drawn at the top). [Figure 1] A torus, for example, can be viewed as the composition of the building blocks. [Figure 2]

We studies TQFT in the category of relations (Rel). A category consists of objects and morphisms for any pair of objects, equipped with an identity morphism for any object and composition for any pair of morphisms such that the right and left unit laws and associativity are satisfied. For the Rel category, the objects are sets and the morphisms from a set X to a set Y are subsets of the tensor product of X and Y.
We showed that such a TQFT can be described by a combinatorial structure called a "simplicial set". Intuitively, a simplicial set is the generalization of geometric simplicial complexes. A simplicial set contains points (known as 0-simplices) and edges connecting some of the points (known as 1-simplices). It may also contain higher level of simplices. For instance, a 2-simplex can be viewed as the triangular shape bounded by three points and three edges. We found a way to characterize the simplicial sets that are in one-to-one correspondence with TQFT's.

SURF 2018-Post SURF Survey

Name	Rebecca Braverman
Year of Graduation	2020

Are you in a Graduate program?	no
SURF Advisor	Randy Frost, Psychology
Advisor Department	Psychology
SURF Field of Study	Psychology
Please list co-authors of your abstract	Molly Eldevik (2019), Mercedes Woolley (2020)
Upload image(s) in .png format; 1,100 MB max size each	

SCI		SI-R Total	DD	AQ	CL
	EA	.329*	.315*	0.189	.256*
	Con	0.048	0.045	0.051	-0.003
	Resp	0.233	0.21	-0.044	0.262
	Mem	-0.023	0.024	-0.205	0.078

M. Eldevik image 2.png

Prediction Model	β	T-Value	R²
SIR-tot Post			0.554
SIR-tot Pre	0.613	6.26**	
Δ EA	0.102	0.69	
Δ RESP	-0.391	-0.285**	
Δ MEM	-0.207	-1.49	
Δ CON	-0.006	-0.06	
SIR-DD Post			0.401
SIR-DD Pre	0.392	3.42**	
Δ EA	0.143	0.85	
Δ RESP	-0.535	-3.32**	
Δ MEM	-0.086	-0.53	
Δ CON	-0.059	-0.49	
SIR-Acq Post			0.515
SIR-Acq Pre	0.650	6.48**	
Δ EA	-0.096	0.62	
Δ RESP	-0.365	-2.65*	
Δ MEM	-0.005	-0.04	
Δ CON	0.092	0.83	
SIR-Cl Post			0.463
SIR-Cl Pre	0.616	5.81**	
Δ EA	0.229	1.46	
Δ RESP	-0.243	1.64	
Δ MEM	-0.330	2.12*	
Δ CON	-0.028	-0.24	

M. Eldevik image 3.png

M.Eldevik image 1-1.png

M.Eldevik image 1.png

Title of Abstract/Research	Predictors of Outcome in the Buried in Treasures Workshop for Hoarding

Please type your abstract below.

The Buried in Treasures Workshop (BIT) is a biblio-based treatment group for individuals who struggle with excessive hoarding, saving, and acquiring of possessions. Members of the BIT group meet weekly for a session facilitated by a clinician or trained peer. Each session focuses on a chapter of Tolin et al.'s (2014) Buried in Treasures: Help for Compulsive Acquiring, Saving, and Hoarding, which guides participants through the process of confronting and managing their hoarding problems. Previous research has found that participating in the BIT workshop significantly reduced hoarding behavior compared to a waitlisted group (Frost et al., 2011; Frost et al., 2012)and that the effects of the BIT workshop are comparable to those of cognitive behavioral therapy (Mathews et al., 2014). Despite this empirical support, many members of the BIT workshop still struggle with hoarding following treatment. This research aims to identify the predictors of success in the BIT workshop to potentially improve the program and reduce the difficulty experienced by participants post treatment. This study examined 56 individuals who completed the BIT workshop in Santa Monica, California and Northampton, Massachusetts. Sixteen sessions took place over a period of four months. The participants responded to two measures of hoarding symptomology, the Savings Cognition Inventory (SCI) and the Saving Inventory Scale- Revised (SI-R), before and after treatment. Pretest and posttest scores were compared using a general linear model and linear regressions were used to examine the effect of pretreatment saving cognitions and changes in saving cognitions on hoarding symptoms. Analysis showed significant decreases in hoarding symptoms and beliefs (p's < .001). Correlations between percent change in hoarding symptoms and pretest SCI scores revealed significant and positive correlations between hoarding symptoms and SCI Emotional Attachment. Linear regression analysis revealed that higher pretreatment scores on the Emotional Attachment subscale of the SCI predicted lower posttest scores on the SI-R total, the SI-R Difficulty Discarding subscale, and the SI-R Clutter subscale after controlling for pretext scores on the SI-R. Changes in saving cognitions (SCI) were correlated with changes in hoarding symptoms (SI-R). Of the 16 correlations, 14 were significant. SCI Responsibility showed the strongest correlations (rs from .33 to .55). Linear regression analysis showed that pretest to posttest changes in SCI Responsibility predicted a lower total score on the SI-R and lower scores on the SI-R Difficulty Discarding subscale and the SI-R Excessive Acquisition Subscale after controlling for pretest values and the other SCI subscales. Only change in SCI Memory predicted lower SI-R clutter. These findings suggest that individuals with heightened feelings of responsibility for possessions may achieve a better outcome in the BIT workshop than those who experience heightened emotional attachment, memory, or a need to control possessions. These results are consistent with research on the importance of waste avoidance as a

fundamental mechanism in hoarding disorder (Dozier & Ayers, 2014; Frost et al., 2015). Further measurement of changes in SCI Responsibility is needed to establish whether these changes mediate changes in the SI-R. References: Dozier, M.E. & Ayers, C.R. (2014). The predictive value of different reasons for saving and acquiring on hoarding disorder symptoms. Journal of Obsessive-Compulsive and Related Disorders, 3, 220-227. Frost, R. O., Pekareva-Kochergina, A., & Maxner, S. (2011). The effectiveness of a biblio-based support group for hoarding disorder. Behaviour Research And Therapy, 49(10), 628-634. doi:10.1016/j.brat.2011.06.010 Frost, R. O., Ruby, D., & Shuer, L. J. (2012). The buried in treasures workshop: Waitlist control trial of facilitated support groups for hoarding. Behaviour Research And Therapy, 50(11), 661-667. doi:10.1016/j.brat.2012.08.004 Frost, R.O., Steketee, G., Tolin, D.F., Sinopoli, N., & Ruby, D. (2015). Motives for acquiring and saving in hoarding disorder, OCD, and community controls. Journal of Obsessive-Compulsive and Related Disorders, 4, 54-59. Mathews, C., Uhm, S., Chan, J., Gause, M. Franklin, J., et al. (2016). Treating hoarding disorder in a real-world setting: Results from the mental health association of San Francisco. Psychiatry Research, 237, 331-338. Tolin, F.D., Frost, R. O., & Steketee, G. (2014). Buried in Treasures: Help for Compulsive Acquiring, Saving, and Hoarding (2nd ed.). New York, NY: Oxford University Press. (Supported by SURF Fund) Advisor: Randy O. Frost

SURF 2018-Post SURF Survey

Name	Olivia Leadbetter
Year of Graduation	2019

Are you in a Graduate program?	no
SURF Advisor	Sara Pruss, Geosciences
Advisor Department	Geosciences
SURF Field of Study	Geoscience (Invertebrate Paleontology)
Title of Abstract/Research	Analysis of pre-extinction Archaeocyathan reefs of the Lower Cambrian Harkless Formation, Southwest Nevada

Please type your abstract below.

Olivia Leadbetter '19
SURF Abstract
Smith College Department of Geosciences
Advisor: Sara Pruss

Analysis of pre-extinction Archaeocyathan reefs of the Lower Cambrian Harkless Formation, Southwest Nevada

Archeaocyaths are an extinct group of marine sponges and were the first calcifying metazoan reef builders in oceans dominated by microbial reefs (Rowland and Shapiro, 2002). They appeared first in the early Cambrian, 40 million years before calcifying metazoan reef builders radiated in the Ordovician (Rowland and Hicks, 2004). Near Gold Point Nevada, Lower Cambrian strata including the Poleta and Harkless formations are well exposed and host several horizons of archaeocyath reef build ups (Stewart, 1970). It is either during Harkless time or just after that the archaeocyaths disappear entirely, marking the end of the first wave of animal reef building in the Paleozoic (Debrenne, 1991; Zhuravlev, 1996; Rowland and Shapiro, 2002). This Harkless succession likely contain the last archeaocyathan reefs in the Western United States before their demise during the early Cambrian Extinction (Zhuravlev et al 1996).

During Spring 2018, I completed a special studies where I examined reef samples from one reef and adjacent facies preserved in the upper Harkless Formation (S1B locality, Figure 1), collected during a field season in the summer of 2017. My goal was to produce a preliminary picture of the diversity and abundance of organisms in these reefs, since they are the last known archaeocyathan reefs in the western US.

Using this research as a foundation, I traveled back to Nevada with Professor Pruss at the beginning of Summer 2018, during which time we collected samples along reef facies exposed at the GPS-1 locality (GPS-1, Figure 1). We sketched, mapped, and sampled two reefs extensively so that we could continue my work quantifying the components of these reefs back at Smith. We also measured three stratigraphic sections and collected samples from laterally correlative facies (GPS-3 and 4, Figure 1) where we expected to capture a negative carbon isotope excursion that we discovered during the 2017 field season. This was done with the goal of developing more precise carbon isotope profiles pinpointing the excursion.

Upon returning to Smith College, I prepared powder samples of the carbonate rocks collected through the stratigraphy. These samples were then sent to David Fike's lab at Washington University for carbon isotope analysis through mass spectrometry using a Gas Bench II Coupled to a Delta V Advantage mass-spectormeter. The data that was returned was plotted against corresponding stratigraphic columns.

I spent the rest of the summer working with samples collected from the Harkless Formation. This was with the goal of characterizing the nature and diversity of archaeocyathan reefs and surrounding facies at this crucial pre-extinction interval. This involved preparing thin sections of reef samples that I then analyzed using the grain solid point counting method (Flugel, 2004) to quantify skeletal and mineral abundance. This data was then graphed using excel and KaleidaGraph software. Photomicrographs were then taken of these thin sections to create a library of representative features of interest from the various rock facies (Figure 2). Samples from channel facies and reef adjacent facies were dissolved in acid, and the residues were sieved, picked, and imaged using a Scanning Electron Microscope (Figure 3).

From my research this summer, I can characterize GPS-1 Upper Harless Reefs as being a consortium of calcimicrobes and archaeocyaths where the reef framework is dominated by the calcimicrobe Renalcis, indicating a shallow carbonate shelf environment above the slope. (Rowland and Hicks, 2004). Though archaeocyaths were present in almost all reef samples, non archaeocyathan fossil fragments were rare to non- existent here.

Many of the reef samples contained glauconite and quartz grains, however these minerals were most abundant in the uppermost reef samples. In some cases, they were even observed within archaeocyath walls. This is consistent with these reefs being smothered by migrating sand bars of terrigenous material.

The grainstone channel and reef adjacent facies rich in quartz and glauconite grains were also quantified in their abundance of total fossil material. No archaeocyaths were observed in grainstone channels or reef adjacent facies, however trilobites, echinoderms, Salterella, and brachiopods were all present. After diluting ( ) of these samples in dilute acetic acid, we discovered an array of small shelly fossils that exhibited a range of minerals replacing skeletal structures. Bright Green hexanellid sponge spicules were confirmed by EDS to be glauconite, and red brown chancelloriid spicules/fragment are iron oxides. Further work with constrain the environmental conditions near these reefs that fostered iron minerals replacing the skeletal components of animals.

All of this work points to a thriving and complex reef ecosystem that existed prior to archaeocyath extinction in the upper Harkless Formation. Reef samples and reef adjacent samples produced diverse and abundant skeletal components in thin section and in insoluble residues of carbonate. The presence of skeletons replaced by iron minerals also hints at a complex diagenetic history for this reef, all of which will be explored during my thesis work.

Figures:

Figure 1: Map showing GPS and S1B sample collection sites in southwest Nevada near Gold Point

Figure 2: Photomicrograph of GPS-1 reef sample. Archaeocyath cup surrounded by shruby Renalcis microbial fabric

Figure 3: Small shelly fossils picked from grainstone channel cutting through Harless Reef. Green hexanellid sponge spicule (image a) is photographed using the SEM (image b).

References:

ROWLAND, S. and SHAPIRO, R. 2002, Reef patterns and environmental influences in the Cambrian and earliest Ordovician, in Kiessling, W., and Flugel, E., Phanerozoic reef patterns, SEPM Special Publication 72, DOI10.2110/pec.02.72.0095.

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FLÜGEL, E. 2004. Microfacies of Carbonate Rocks. Analysis, Interpretation and Application, Springer, Berlin, 916 pp.

HILL, D. 1972 Archaeocyatha. In C. Teichert, ed., Treatise on Invertebrate Paleontology, Part E, Volume 1, 2nd ed. Geological Society of America 7 University of Kansas. Boulder, Lawrence

SURF 2018-Post SURF Survey

Name	Stormi Smith **Smith**
Year of Graduation	2020
Are you in a Graduate program?	no
SURF Advisor	Mary Harrington, Neuroscience
Advisor Department	Neuroscience
SURF Field of Study	Circadian Rhythms
Title of Abstract/Research	Tracking the effects of Estrous and Anesthesia on core body temperature in mice

Please type your abstract below.

Monitoring core body temperature is important when handling mice. Different factors can affect a mouse's ability to regulate their body temperature. The research conducted wanted to study the effect of two different types of factors and how they affect core body temperature.

One factor is a biological cycle found in female mammals, the estrous cycle. The estrous cycle in female mice last 4-5 days. During the cycle the actual mating occurs on 1 day, this day is also known as being in heat. The question was, can a female mouse's estrous cycle, in particular the day of heat, be tracked over time? Is it rhythmic? The researcher hypothesized that the estrous cycle would causes an increase in body temperature over those 4-5 days, in particularly on the mouse's day of heat. In the end, the graphs created by Matlab, illustrated there may be a slight increase in body temperature on the day of heat. However, tracking the full cycle became difficult since it seemed to be arrhythmic. There were days in which body temperature was higher, but it did not follow a 4-5-day pattern.

The second factor was researcher induced, anesthesia. Anesthesia is known to causes a decrease in body temperature. During procedures, mice are given isoflurane for approximately 20 minutes. The experimental question was, does isoflurane cause a decrease in body temperature and for how long? Does the combination of surgery and isoflurane cause a drastic decrease in body temperature? For this experiment 7 mice were placed under isoflurane for 20 minutes and then placed back into their housing. The researcher monitored their body temperature for several days after the test. Using previous data, 7 animals, all which had an actual surgery done on them, were used to test the combination of the two. In conclusion, when mice are just placed under isoflurane without undergoing surgery, the average disruption of body temperature lasted for 12 hours. When mice underwent surgery their body temperature disruption was on average a day and a half. Concluding that surgery seems to causes a larger disruption in body temperature then anesthesia on its own.

SURF 2018-Post SURF Survey

Name	Molly Eldevik **Smith**
Year of Graduation	2019
Are you in a Graduate program?	no
SURF Advisor	Randy Frost, Psychology
Advisor Department	Psychology
SURF Field of Study	Psychology
Please list co-authors of your abstract	Rebecca Braverman, Mercedes Woolley

Upload image(s) in .png format; 1,100 MB max size each

SCI	SI-R Total	DD	AQ	CL
EA	.329*	.315*	0.189	.256*
Con	0.048	0.045	0.051	-0.003
Resp	0.233	0.21	-0.044	0.262
Mem	-0.023	0.024	-0.205	0.078

M. Eldevik image 2.png

Prediction Model	β	T-Value	R²
SIR-tot Post			0.554
SIR-tot Pre	0.613	6.26**	
Δ EA	0.102	0.69	
Δ RESP	-0.391	-0.285**	
Δ MEM	-0.207	-1.49	
Δ CON	-0.006	-0.06	
SIR-DD Post			0.401
SIR-DD Pre	0.392	3.42**	
Δ EA	0.143	0.85	
Δ RESP	-0.535	-3.32**	
Δ MEM	-0.086	-0.53	
Δ CON	-0.059	-0.49	
SIR-Acq Post			0.515
SIR-Acq Pre	0.650	6.48**	
Δ EA	-0.096	0.62	
Δ RESP	-0.365	-2.65*	
Δ MEM	-0.005	-0.04	
Δ CON	0.092	0.83	
SIR-Cl Post			0.463
SIR-Cl Pre	0.616	5.81**	
Δ EA	0.229	1.46	
Δ RESP	-0.243	1.64	
Δ MEM	-0.330	2.12*	
Δ CON	-0.028	-0.24	

M. Eldevik image 3.png

M.Eldevik image 1.png

Title of Abstract/Research

Predictors of Outcome in the Buried in Treasures Workshop for Hoarding

Please type your abstract below.

The Buried in Treasures Workshop (BIT) is a biblio-based treatment group for individuals who struggle with excessive hoarding, saving, and acquiring of possessions. Members of the BIT group meet weekly for a session facilitated by a clinician or trained peer. Each session focuses on a chapter of Tolin et al.'s (2014) Buried in Treasures: Help for Compulsive Acquiring, Saving, and

Hoarding, which guides participants through the process of confronting and managing their hoarding problems. Previous research has found that participating in the BIT workshop significantly reduced hoarding behavior compared to a waitlisted group (Frost et al., 2011; Frost et al., 2012)and that the effects of the BIT workshop are comparable to those of cognitive behavioral therapy (Mathews et al., 2014). Despite this empirical support, many members of the BIT workshop still struggle with hoarding following treatment. This research aims to identify the predictors of success in the BIT workshop to potentially improve the program and reduce the difficulty experienced by participants post treatment. This study examined 56 individuals who completed the BIT workshop in Santa Monica, California and Northampton, Massachusetts. Sixteen sessions took place over a period of four months. The participants responded to two measures of hoarding symptomology, the Savings Cognition Inventory (SCI) and the Saving Inventory Scale- Revised (SI-R), before and after treatment. Pretest and posttest scores were compared using a general linear model and linear regressions were used to examine the effect of pretreatment saving cognitions and changes in saving cognitions on hoarding symptoms. Analysis showed significant decreases in hoarding symptoms and beliefs (p's < .001). Correlations between percent change in hoarding symptoms and pretest SCI scores revealed significant and positive correlations between hoarding symptoms and SCI Emotional Attachment. Linear regression analysis revealed that higher pretreatment scores on the Emotional Attachment subscale of the SCI predicted lower posttest scores on the SI-R total, the SI-R Difficulty Discarding subscale, and the SI-R Clutter subscale after controlling for pretext scores on the SI-R. Changes in saving cognitions (SCI) were correlated with changes in hoarding symptoms (SI-R). Of the 16 correlations, 14 were significant. SCI Responsibility showed the strongest correlations (rs from .33 to .55). Linear regression analysis showed that pretest to posttest changes in SCI Responsibility predicted a lower total score on the SI-R and lower scores on the SI-R Difficulty Discarding subscale and the SI-R Excessive Acquisition Subscale after controlling for pretest values and the other SCI subscales. Only change in SCI Memory predicted lower SI-R clutter. These findings suggest that individuals with heightened feelings of responsibility for possessions may achieve a better outcome in the BIT workshop than those who experience heightened emotional attachment, memory, or a need to control possessions. These results are consistent with research on the importance of waste avoidance as a fundamental mechanism in hoarding disorder (Dozier & Ayers, 2014; Frost et al., 2015). Further measurement of changes in SCI Responsibility is needed to establish whether these changes mediate changes in the SI-R.
References: Dozier, M.E. & Ayers, C.R. (2014). The predictive value of different reasons for saving and acquiring on hoarding disorder symptoms. Journal of Obsessive-Compulsive and Related Disorders, 3, 220-227. Frost, R. O., Pekareva-Kochergina, A., & Maxner, S. (2011). The effectiveness of a biblio-based support group for hoarding disorder. Behaviour Research And Therapy, 49(10), 628-634. doi:10.1016/j.brat.2011.06.010 Frost, R. O., Ruby, D., & Shuer, L. J. (2012). The buried in treasures workshop: Waitlist control trial of facilitated support groups for hoarding. Behaviour Research And Therapy, 50(11), 661-667. doi:10.1016/j.brat.2012.08.004 Frost, R.O., Steketee, G., Tolin, D.F., Sinopoli, N., & Ruby, D. (2015). Motives for acquiring and saving in hoarding disorder, OCD, and community controls. Journal of Obsessive-Compulsive and Related Disorders, 4, 54-59. Mathews, C., Uhm, S., Chan, J., Gause, M. Franklin, J., et al. (2016). Treating hoarding disorder in a real-world setting: Results from the mental health association of San Francisco. Psychiatry Research, 237, 331-338. Tolin, F.D., Frost, R. O., & Steketee, G. (2014). Buried in Treasures: Help for Compulsive Acquiring, Saving, and Hoarding (2nd ed.). New York, NY: Oxford University Press.

SURF 2018-Post SURF Survey

Name	Dinah Nahid **Smith**
Year of Graduation	2019
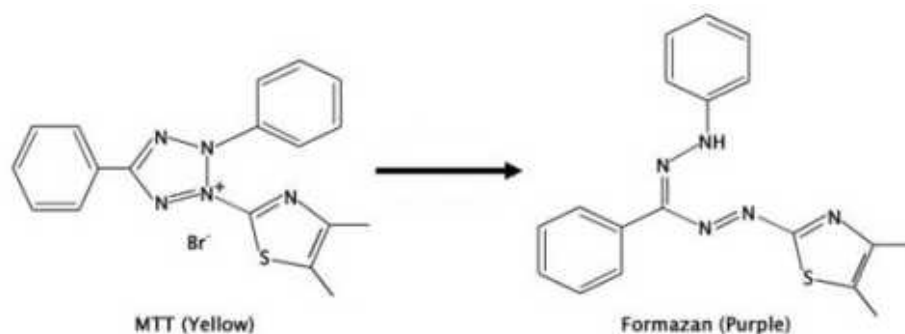
Are you in a Graduate program?	no
SURF Advisor	Steven Williams, Biological Sciences
Advisor Department	Biological Sciences
SURF Field of Study	Biological Sciences
Upload image(s) in .png format; 1,100 MB max size each	NADPH-dependent cellular oxidoreductase reaction from MTT to Formazan. MTT Formazan- D.Nahid.png
Title of Abstract/Research	Determining the Toxicity and Mutagenicity of Sesquiterpene Lactone Compounds Derived from Neurolaena lobata

Please type your abstract below.

Lymphatic filariasis is a tropical disease caused by parasitic nematodes that infect hundreds of millions of people worldwide. Improved drugs are needed that can effectively kill these parasites in the human host. In collaboration with the Shea lab, the Williams lab has tested various sesquiterpene lactones derived from a compound called Neurolenin D on a filarial nematode called Brugia pahangi. Although, this nematode does not infect humans, it is biologically similar to one that does, Brugia malayi. Neurolenin D is a naturally occurring compound derived from the Neurolaena lobata plant, which can be extracted and converted to other compounds via various organic chemical reactions. The most promising of these compounds is Neurolenin B. The toxicity and mutagenicity of these compounds must be determined early in the drug discovery process to demonstrate the probable safety of any potential drug. Such testing is required before pharmaceutical companies will show interest in new drug candidates. This summer, my research focus was on the toxicity and mutagenicity of these compounds. This was executed through detailed literature review, protocol development, and design of experimental procedures. Toxicity can be determined using the MTT assay, which quantifies cell viability and proliferation. It utilizes the biochemical reaction that converts yellow tetrazolium MTT [3-(4,5-dimethylthiazolyl-2)-2,5-diphenyltetrazolium bromide] into insoluble (E,Z)-5-(4,5-dimethylthiazol-2-yl)-1,3-diphenylformazan (formazan). The formazan product can be dissolved with dimethyl sulfoxide to give a purple color at a characteristic absorption of 540 nm. The intensity of the resulting purple color is directly proportional to cell number and thus an indicator of cell viability. The cell type we plan on utilizing for this assay is HepaRG, which is an immortalized human liver cell line used for toxicity testing. Other cell lines could be used, but most literature supports the use of this line because it retains the expression of liver-specific functions and has yielded data that is reproducible and consistent. Mutagenic compounds are chemical agent that can alter genetic material, typically DNA, and can therefore damage cells. To screen for mutagenicity, we decided to conduct the Ames test. Though the Ames test has been used before in this project, the results of that experiment were inconclusive and further investigation is required. The original Ames experiments were done from scratch, whereas this year we plan to use a kit from Moltox for a more controlled experiment, which is expected to yield more conclusive data.

SURF 2018-Post SURF Survey

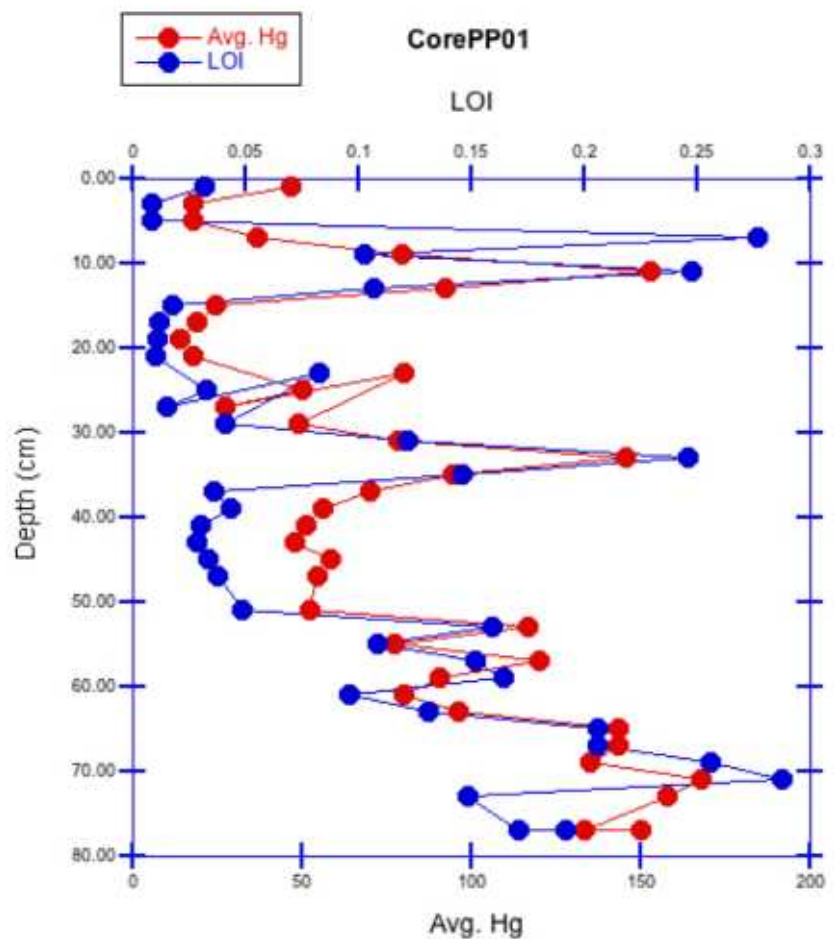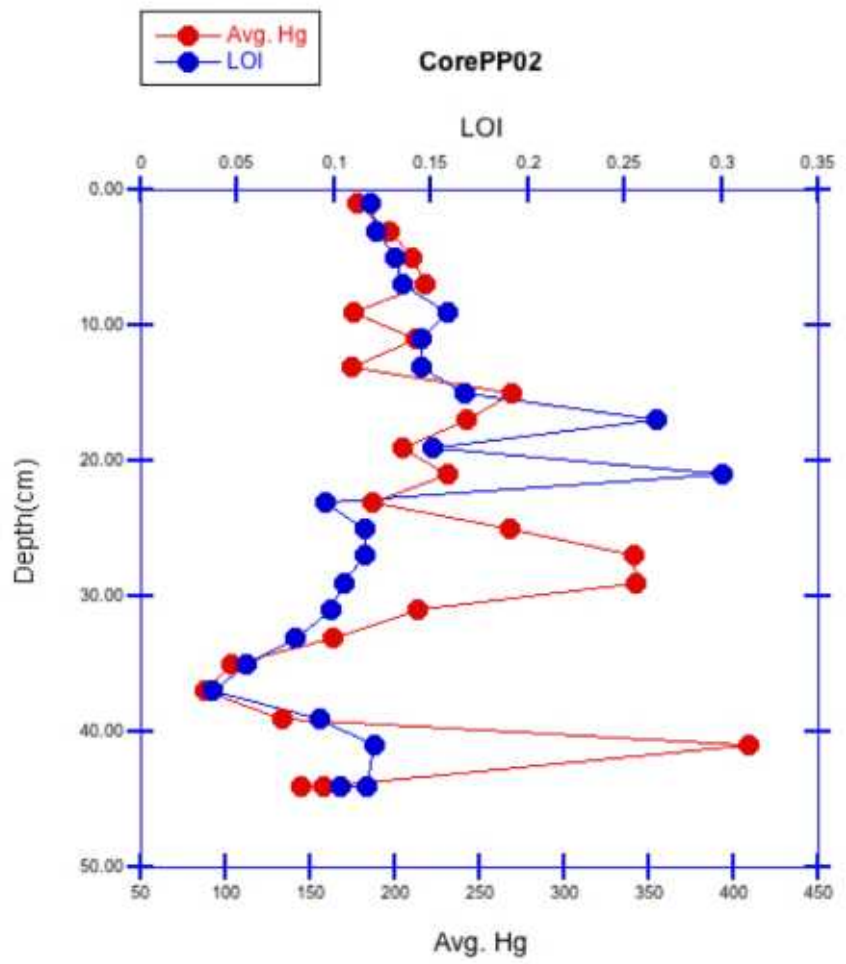|	
Name	Moira Pitrat
Year of Graduation	2020
Are you in a Graduate program?	no
SURF Advisor	Robert Newton, Geosciences
Advisor Department	Geosciences
SURF Field of Study	Geosciences
Upload image(s) in .png format; 1,100 MB max size each	

Figure1mpitrat.png

Figure2mpitrat.png

| Title of Abstract/Research | Heavy Metal Contamination of Paradise Pond Sediments |

Please type your abstract below.

The new Paradise Pond sediment management plan involves releasing pond sediment downstream through a sluicing process during high discharge events. One of the principle environmental concerns associated with this process involves the downstream release of heavy metals from potentially contaminated pond sediment. To address this issue, four sediment cores were taken from different locations within the pond using a Uwitec Gravity corer. The cores were 8.6cm in diameter and up to 1m in length. Each core was extracted in the field and samples were collected at 2cm intervals. Subsamples from each 2cm interval were digested to release metals using concentrated hydrochloric and nitric acid at high temperature in a microwave digester. Digestion extracts were analyzed by Inductively Coupled Plasma Optical Emission Spectroscopy (ICP-OES) for manganese, zinc, nickel, cadmium, copper, potassium, silica, aluminum, and iron using a Teledyne Leemann Prodigy, while lead was analyzed by Graphite Furnace Atomic Adsorption Spectroscopy (GFAAS) using a Perkin Elmer AAnalyst 600. A separate sediment subsample was analyzed directly for total mercury using a Teledyne Leeman HydraC mercury analyzer by Thermal Decomposition Cold Vapor Atomic Adsorption.

In general, heavy metal concentrations were within acceptable limits for dredged material. In addition, there were some interesting relationships found between some of the measured parameters. Core PP01, taken near the dam, showed an increase in mercury concentration as depth increased and also showed a positive correlation between average mercury and Loss On Ignition (LOI) (Figure 1). LOI was determined from the loss of mass during the thermal decomposition of the sample during mercury analysis. In this case LOI is most likely associated with the amount of organic material in the core. Mercury is frequently found bound to organic material. Core PP01 also had spikes roughly every 20 centimeters which could be due to seasonal leaf layers. Core PP02, taken near the boat house, showed higher concentrations of mercury with relatively lower LOIs, which suggests the mercury levels at this site could be coming from a different source, possibly residual material from prior coal burning on campus (Figure 2).

Core PP02 had the highest concentrations of lead and copper compared to other cores, while core PP03, taken near the island, had the highest manganese and zinc concentrations. Core PP04 was taken on the sand bar, formed where the Mill River enters the pond and had the lowest heavy metal concentrations, most likely because it is so sandy at that site.

Figure 1. Changes in concentration of mercury in relation to depth at site one.

Figure 2. Changes in concentration of mercury in relation to depth at site two.

SURF 2018-Post SURF Survey

Name	Zhenyao Cai
Year of Graduation	2019

SURF Advisor	R.Jordan Crouser, Statistical and Data Sciences
Advisor Department	Computer Science
SURF Field of Study	Smith College Learning Space Assessment
Please list co-authors of your abstract	Chen Li，Chris Xiaoyue Tan， Hening Zheng，Starry Yujia Zhou

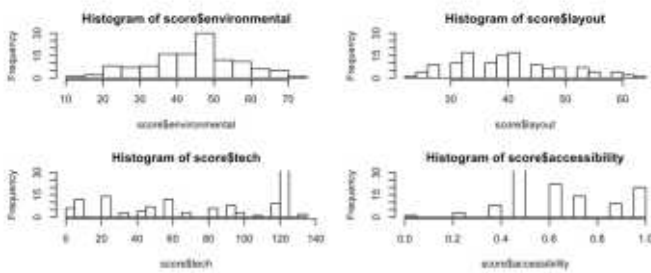## Upload image(s) in .png format; 1,100 MB max size each

Figure 1: A histogram for the numerical explanatory variables in Sasaki scores.

1.png

Variable 1	Variable 2	Correlation
tech	information	0.41
accessibility	layout	0.33
tech	environmental	0.21
accessibility	environmental	0.17
information	room capacity	0.16
layout	environmental	0.15
accessibility	final score	0.14
tech	room capacity	0.08
tech	final score	0.03
environmental	final score	0.01
environmental	information	0.01
layout	final score	-0.02
accessibility	room capacity	-0.03
layout	room capacity	-0.08
room capacity	final score	-0.09
information	final score	-0.09
accessibility	information	-0.21
environmental	room capacity	-0.22
tech	layout	-0.22
layout	information	-0.26
accessibility	tech	-0.3

Table 1: A table illustrating the correlation of each pair of variables in Sasaki scores.
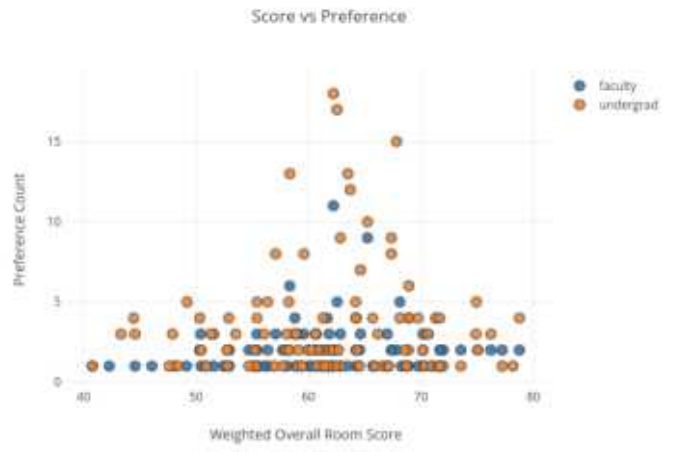
2.png

Score vs Preference

Figure 2: Sasaki Score vs. Faculty and Student Preference
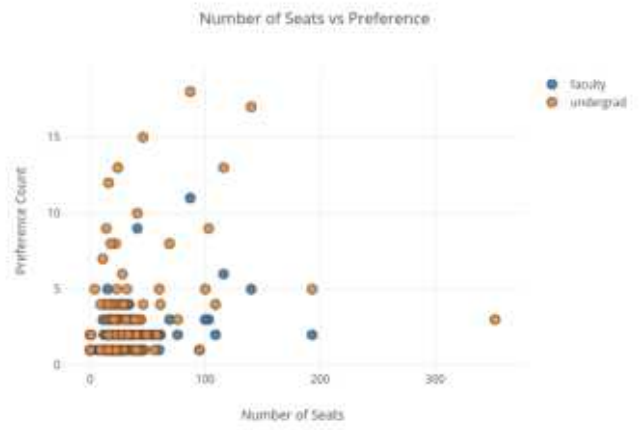
3.png

Number of Seats vs Preference

Figure 3: Number of Seats vs. Faculty and Student Preference

4.png

Figure 4: Faculty Preference by Academic Rank

5.png

Figure 5: Classroom usage for course CSC 111 from 2009-2018

6.png
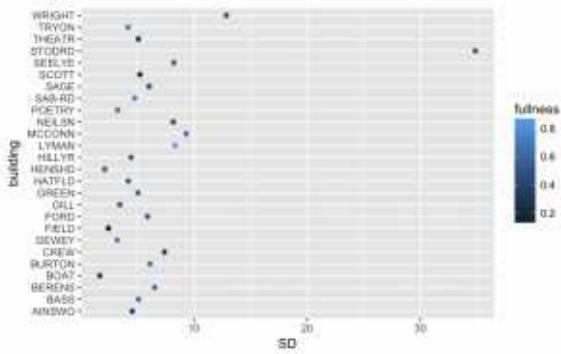
Figure 6: An analysis for classroom chair usage efficiency.

8.png

Building	Standard Deviation	Fullness
AINSWO	4.55	0.35
BASS	5.11	0.64
BERENS	6.53	0.64
BOAT	1.69	0.31
BURTON	6.12	0.64
CREW	7.4	0.34
DEWEY	3.23	0.72
FIELD	2.45	0.11
FORD	5.9	0.53
GILL	3.46	0.53
GREEN	5.05	0.58
HATFLD	4.21	0.56
⋮	⋮	⋮

Building	Standard Deviation	Fullness
HENSHD	2.12	0.57
HILLYR	4.45	0.57
LYMAN	8.34	0.88
MCCONN	9.32	0.64
NEILSON	8.18	0.45
POETRY	3.27	NA
SAB-RD	4.76	0.77
SAGE	6.04	0.44
SCOTT	5.23	0.17
SEELYE	8.23	0.54
STODRD	34.86	0.53
THEATR	5.09	0.3
TRYON	4.18	0.7
WRIGHT	12.86	0.45

7.png

Title of Abstract/Research   Smith College Learning Space Assessment Report

Please type your abstract below.

In 2017-2018, Smith College contracted Sasaki Associates, Inc. to conduct a survey of Smith College study space analysis. During the summer of 2018, five undergraduate student researchers in the Human Computation and Visualization Laboratory conducted additional analysis of the collected data under the supervision of Prof. R. Jordan Crouser.

This reanalysis of Smith Space Usage focused on evaluating utilization rates, technology deployment, campus geography and the physical condition of classroom spaces. The goal of this study is to identify potential methods to support faculty with their diverse pedagogy and enhance student learning experiences.

The assessment was summarized as the convergence of the following two themes: Teaching, and Allocating.

There are several essential goals we hope to achieve:
• Understand current utilization of classrooms
• Assess adequacy of instructional technology
• Develop a decision-making interface to help resource allocation and room assignment

SURF 2018-Post SURF Survey

Name	Yuhan Wen
Year of Graduation	2020

Are you in a Graduate program?	no
SURF Advisor	Kristen Dorsey, Engineering
Advisor Department	Engineering
SURF Field of Study	Soft Robotics and sensor fabrication

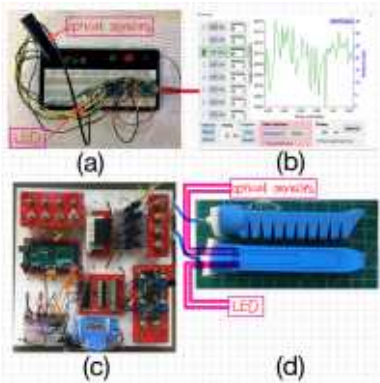**Upload image(s) in .png format; 1,100 MB max size each**

Fig. 1. Schematic Diagrams of the soft gripper system. (a) Optoelectronics include LED light source, Arduino Nano, Adafruit multiplexer, and optical sensors with acrylic housing. (b) Matlab GUI reads optical sensor data. (c) Control board determines and measures air pressure inside gripper chambers. (d) Soft grippers with bellows and optical waveguides.
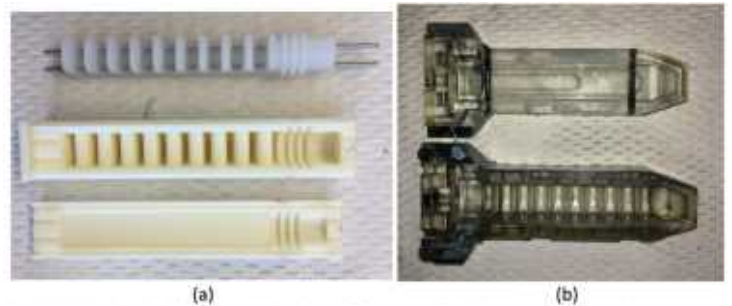
Fig1_YWen.png

Fig. 2. 3D printed molds. (a) core molds and core; (b) outer molds with waveguide channels.

Fig2_YWen.png

Fig. 3. Finger opening, plug and fitting (from left to right)

Fig3_YWen.png

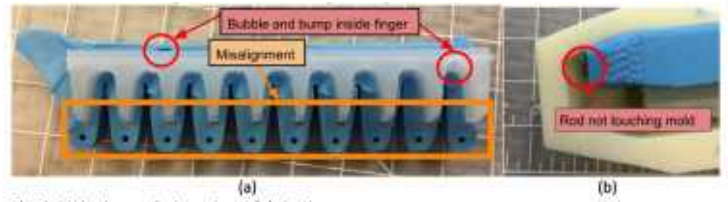**Fig. 4.** Major issues during gripper fabrication process
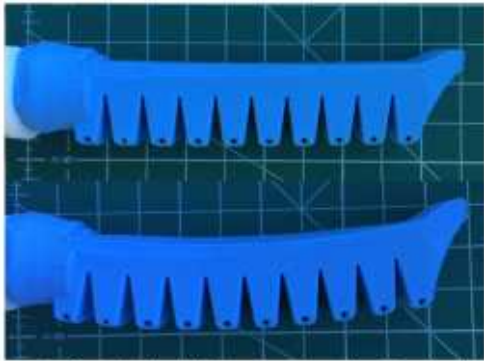
Fig4_YWen.png

Fig. 5. Unactuated(top) and slightly pressurized(bottom) gripper

Fig5_YWen.png

| **Title of Abstract/Research** | Design and fabrication of soft pneumatic gripper for deep-sea organism manipulation |

Please type your abstract below.

Introduction:
Deep-sea organism, like coral reefs, are of interest for the scientific community to understand genetic adaptions and biodiversity of the ecosystems [1]. This project aims to manufacture soft grippers that actuates pneumatically for biological sampling in deep sea. To facilitate motion planning, soft optical waveguides that give different light intensity loss under deformation are integrated to measure curvature and contact force. This summer, I focused on the fabrication process of the gripper and the setup of control system, optoelectronic testbed, and pneumatic connection design.

Methods:
Fig. 1 shows the schematic of connection between compartments.

Actuator fabrication:
We use a two-step molding method proposed in [1]. A core piece made of Dragon Skin 20 is placed inside the outer molds filled with Smooth-Sil 950 to generates hollow chambers in the gripper(Fig. 2). A pair of metal rods are cured with the core as reference to ensure precise alignment between the core and the gripper. They later fit into designed slots in the outer molds. When everything is cured, we pull out the core from the finger, and connect the finger opening to a barbed fitting (McMaster-Carr 5012K24) via a custom plug.

Optoelectronics:
We used LED emitter (SFH 756V, Avago) as input light and light intensity sensors (LTR-329ALS-01, Lite-on) to determine light intensity loss in the waveguide. Sensors are mounted by a reflow process on custom PC boards designed on AutoDesk Eagle. To eliminate the effect of ambient light, we laser-cut and assembled opaque acrylic housing for the boards. We used an Arduino Nano and an multiplexer (TCA9548A) for data reading, and used Matlab to create a user-friendly interface (Fig. 1b).

Results and Discussion:
Smooth-Sil 950 is a very viscous material (35,000 cps viscosity), which demands thorough degassing to prevent air bubbles. Places where air bubbles are trapped (Fig.4a) fail easily under actuation. Another type of failure comes when metal rods don't go completely into the slots(Fig. 4b). The thinner wall side usually deforms dramatically under pressure and fail.
The inflated chambers in Fig. 6 prove that there is no air leak and the proposed fabrication process works as expected.

Reference:
[1] K. C. Galloway et al., "Soft Robotic Grippers for Biological Sampling on Deep Reefs," Soft Robot., vol. 3, no. 1, pp. 23–33, Jan. 2016

SURF 2018-Post SURF Survey

Name	Shaia Bierman-Chow
Year of Graduation	2020

Are you in a Graduate program?	no
SURF Advisor	Christine White-Ziegler, Biological Sciences
Advisor Department	Biological Sciences
SURF Field of Study	Biochemistry
Title of Abstract/Research	Environmental Triggers Regulate Uropathogenic Escherichia Coli Fimbrial Adhesion Expression

Please type your abstract below.

Shaia Bierman-Chow
Environmental Triggers Regulate Uropathogenic Escherichia Coli Fimbrial Adhesion Expression

Bacteria colonize their hosts through a series of mechanisms often triggered by external cues such as pH, oxygen levels, and temperature (1) Numerous experimental studies show that Escherichia coli responds to multiple environmental cues (2).The White-Ziegler lab focuses specifically on temperature and the changes in gene expression between room temperature (23˚C) and body temperature (37˚C) to characterize the adaptive strategies employed when bacteria transition between external and host environment. The development of novel drugs targeting the genes which control these key mechanisms of survival and colonization may prove to be extremely effective in treating infection. The lab utilizes a comparative approach utilizing three strains of E. coli: a K-12 nonpathogenic commensal, a uropathogen (UPEC), one of the main causes of urniary tract infections (3) and an enteropathogen (EPEC) responsible for infectious diharea in the developing world among pediatric populaitons (4). Previous work has identified at least 122 genes in the commensal strain which increase in expression at 37ºC (2) and 297 genes which increase at 23ºC (2). Unpublished data from the lab show a similar pattern in the UPEC and EPEC pathogenic strains, suggesting that temperature is a crucial cue in survival and pathogenicity. Studying thermoregulated genes and identifying those conserved across strains may lead to novel drug targets as the threat of increasing antibiotic resistance grows.

My project focused specifically on UPEC, the primary cause of urinary tract infections which will affect 40% women and 12% of men in their lifetime and costs the U.S 3.5 billion dollars annually in health care (5). UPEC contains approximately 10 pathogenicity islands which code for genes that facilitate infection of the host including surface adhesions, toxins, flagella, immune evasion, and metal acquisition genes (5). In the early stages of host colonization, UPEC relies on fimbriae which facilitate bacterial attachment to host cells and enable the bacteria to bind to the host (5). UPEC strains have been reported to contain at least 10 fimbrial operons, with type 1 and P fimbriae being the most well studied (5). A recent study identified a novel regulator of P-fimbriae, papR, a small regulatory RNA (sRNA) whose expression increases during infection of bladder epithelial cells. sRNAs are non coding RNAs that regulate translation through complimentary binding to mRNA. papR was found to indirectly downregulate P-fimbriae expression by binding papI, an important regulator of the papBA operon known to code for papA, the gene responsible for P-fimbriae (6). PapI regulates phase variation of the pap operon from off to on through facilitating the binding of LRP at sites 1, 2 and 3 to sites 4, 5 and 6 at the promoter site (5). In binding papI, papR inhibits papI function, locking the phase variation in the off position and prevenitng the transcription of genes within that operon. Due to studies from our lab and others showing that genes related to infection, including the papBA operon, are thermoregulated in E.coli (6), I chose to investigate whether papR was temperature regulated and whether this contributes to the temperature regulation of the papBA operon.

To assess changes in gene expression, cells were grown on Lennox broth (LB) agar plates overnight and then transferred to flasks containing LB liquid media where half were incubated at 23ºC and half at 37ºC. RNA from the samples at time points for t=0,0.5,1,2,and 4 hours at both 23ºC and 37ºC were then isolated. To measure mRNA levels of the papA gene, quantitative RT-PCR was completed to confirm the temperature regulation of this PapR targeted operon.

Similar results were obtained from two replicate exeperiments, the expression at 37˚C increases at t=1 hour and remains high through t=4 hours (Fig. 1), consistent with previous results that show that expression of papA increases at body temperature (4) The 23ºC control was linear, suggesting no change in PapA expression as expected at room temperature.This data confirmed the reliability of the RNA sample for QRT-PCR.

In contrast, papR expression followed almost identical trajectories at both 23ºC and 37ºC, indicating that papR is not temperature regulated (Fig.2). However, mRNA level measured were extremely low, indicating the primers may not have worked to accurately measure this sRNA. Previous studies have shown that expression of P-fimbrae in UPEC increases during renal epithelium infection whereas type-1 fimbriae are expressed more predominantly in bladder cell infection due to their greater rigidity that prevents urine flow from washing them off host cells (3). Instead of temperature acting as a cue for the PapR sRNA, there may be other environmental cues in the body responsible for its expression that are specific to certain areas or cells of the body. It would be beneficial to run another QRT-PCR plate with new primers for papR to confirm these results.

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(1) Alexander A. Crofts, Simone M. Giovanetti, Erica J. Rubin, Frédéric M. Poly, Ramiro L. Gutiérrez, Kawsar R. Talaat, Chad K. Porter, Mark S. Riddle, Barbara DeNearing, Jessica Brubaker, Milton Maciel, Ashley N. Alcala, Subhra Chakraborty, Michael G. Prouty, Stephen J. Savarino, Bryan W.Davies, M. Stephen Trent. 2018 Enterotoxigenic E. coli virulence gene regulation in human infections, PNAS
(2) White-Ziegler C. A., Davis T. R. 2009. Genome Wide identification of H-NS-Controlled, Temperature-Regulated Genes in Escherichia Coli K-12, American Society for Microbiology 191:1106-1110.
(3) Nielubowicz G. R, Mobley H. L T. 2010. Host-pathogen interactions in urinary tract infection, Nature 7:430-431.
(4) Vallance, B. A., Chan, C., Robertson, M. L. Finlay, B. B. 2002. Enteropahtogenic and enterohemorrhagic Escherichia coli infections: Emerging themes in pathogenesis and prevention.
(5) Khandige S., Kronborg T., Uhlin B. E., Moller-Jensen J. 2015. sRNA-Mediated Regulation of P-Fimbriae Phase Variation in Uropathogenic Escherichia coli. PLoS Pathog 11(8): e1005109.
(6) White-Ziegler C. A., Angus Hill M. L., Braaten B. A., van der Woude M. W., Low D. A. 1998. Thermoregulation of Escherichia Coli pap transcription: HNS is a temperature-dependent DNA methylation blocking factor. 1998. Mol. Microbiol. 28:1121-1137.

SURF 2018-Post SURF Survey

Name	Chloe Birney
Year of Graduation	2021

Are you in a Graduate program?	no
SURF Advisor	Paramjeet Pati, Engineering
Advisor Department	Engineering
SURF Field of Study	Environmental Engineering
Title of Abstract/Research	Sustainable Food Systems in the City of the Future

Please type your abstract below.

By the year 2050, Earth's current 7.6 billion inhabitants will be joined by more than one billion additional citizens; 70% of those nearly 10 billion people will be living in cities, of which 60% of the urban space does not yet exist.1 Highly functioning, sustainable, and resilient food systems are essential to ensuring the survival and equity of quickly developing population centers. Over the course of investigating existing literature, I compared urban food security trends in the industrialized world (e.g. North America, Australia) with those in the developing world (Africa, Asia) and the recommendations being given to emerging urban centers. Overall, cities as different as Lagos, Nigeria and Melbourne, Australia are among the many across the development spectrum that struggle to healthfully feed their populations.

Urban food systems in the United States today tend to provide enough calories to residents but fail to make nutrient dense foods accessible to all: food deserts and swamps, as the worst afflicted census tracts are called, fall disproportionately in the low-income, minority communities of American cities. Compared to nearby higher income, predominantly white neighborhoods, citizens of food deserts face more obesity and related lifestyle diseases as well as substantially shorter life expectancies.2 Urban centers in the developing world, by contrast, tend not to produce enough calories to sustain skyrocketing populations, their food supply lacking resilience in the face of changing climates and ongoing conflicts. Climate change is greatly affecting global food supply, causing prices to spike and greatly impacting the poorest, fastest growing populations. As weather becomes more extreme, it is imperative that states safeguard food supplies with strategies such as halting the expansion of agriculture into carbon sequestering landscapes, closing yield gaps, increasing efficiency with agricultural resources, shifting diets towards plants, and reducing food loss and waste.

The estimated 70% gap between calories produced today and those required to feed the world in 20501 cannot be solved simply with another food generating solutions like the Green Revolution of the late 20th century: the environmental costs are too great. It is necessary to somehow stem population growth to reduce demand. Increasing access to education in the developing world, especially for women, would likely have the effect of decreasing birth rates, in addition to providing opportunities for mobility and economic success. Overall, efforts to increase equality and sustainability in cities around the world will be essential for a healthy, productive future.

References:
1. The Food and Agriculture Organization of the United Nations. How to Feed the World in 2050 (2009).
2. ACLU. Unshared Bounty: How Structural Racism Contributes to the Creation and Persistence of Food Deserts (New York Law Review Racial Justice Project, 2012).

SURF 2018-Post SURF Survey

Name	Stephanie Konas
Year of Graduation	2020

Are you in a Graduate program?	no
SURF Advisor	Michael Baressi, Biological Sciences
Advisor Department	Biological Sciences
SURF Field of Study	Biology and Education
Please list co-authors of your abstract	Emily Raphael
Upload image(s) in .png format; 1,100 MB max size each	

S. Konas.png

Title of Abstract/Research	The Student Scientists Outreach Program

Please type your abstract below.

The Smith College Student Scientists Outreach Program (SSOP) brings zebrafish from the Barresi Lab, as well as inquiry based curriculum, into middle schools and high schools throughout the Pioneer Valley. The purpose of the program is to provide teachers with Smith College's cutting edge resources to help them teach a variety of units including, genetics, growth and development, and ecology and ecosystems. Our group works closely with teachers to effectively integrate the program's materials for a diverse set of courses, working to improve students' critical thinking skills and spark interest in Science, Technology Engineering, and Math (STEM).

We have worked this summer to develop curriculum that balances teacher autonomy with standardization, drawing from Next Generation Science Standards and the Programme for International Student Assessment (PISA). Using data collected over the school year from STEM identity surveys and critical thinking assessments, we determined that students had slight increase in testing scores, indicating the positive influence of the SSOP. However, grader bias and student participation could have influenced the results of these tests, so we developed a more thorough and precise assessment that determined student's ability to apply the scientific inquiry method to different fictional scenarios (Figure 1).

Alongside our work with curriculum and assessment, we created a website to increase accessibility for students and teachers, bred and researched new zebrafish genetic variates to be used in the program, and matched our curriculum to the chosen standards for the Massachusetts public school system. To continue funding the SSOP, we also helped submit an iTEST grant that will ensure the sustainability of the program. Overall, the SSOP uses college resources, such as zebrafish, to further develop students' understanding of inquiry based science and inspire the next generation of scientists.

SURF 2018-Post SURF Survey

Name	Hannah Inman
Year of Graduation	2020

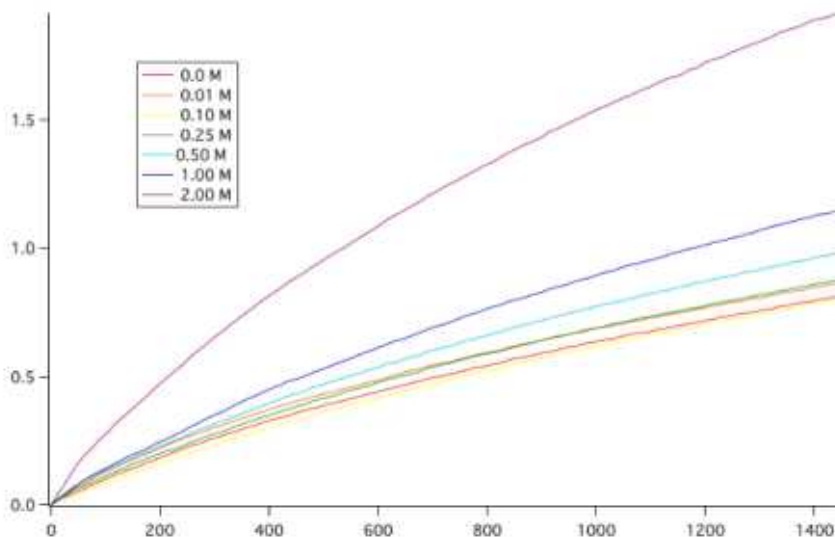|	
Are you in a Graduate program?	no
SURF Advisor	Andrew Berke, Chemistry
Advisor Department	Chemistry
SURF Field of Study	Environmental Chemistry
Please list co-authors of your abstract	Rebecca Miller
Upload image(s) in .png format; 1,100 MB max size each	

Figure 1. Production of imidazole-2-carboxaldehyde in solutions of 3.0 M ammonium sulfate, 0.095 M glyoxal, and 0.0M-1.0M 3-methyl-2-butanol at 29°C.

surf abstract figure.png

Title of Abstract/Research	The Effect of Temperature and Atmospheric Alcohol Concentration on the Thermodynamics of Aerosol Mimicking Solutions

Please type your abstract below.

Organic aerosols (OA) and secondary organic aerosols (SOA) are an interesting and inevitable component of Earth's atmosphere and ecosystems resulting from the partitioning of volatile organic materials. SOAs are formed when a primary pollutant, also know as an OA, reacts with hydroxide, sulfates, nitrates, and/or free radicals in the atmosphere. The product of such reactions is, henceforth, referred to as SOA because it is a secondary environmental pollutant that is formed from a primary pollutant. Aerosols are microscopic particles suspended in the atmosphere that provide a surface for the condensation of water as well as the absorption and scattering of light. The formation of OA and SOA is a topic worth studying because these pollutants can be harmful; therefore, they have an enormous influence on human life and air quality (Yi et al.). Little research has been done to understand the effects of specific alcohols on the reactions of glyoxal with nitrogen-containing compounds. Alcohols are available to these aerosols in the atmosphere, so it is important to observe how different concentrations of alcohols and temperatures affect these reactions.

This research focuses on the effect of alcoholic solvent systems (methanol, ethyl alcohol, tert-butanol, 3-methyl-2-butanol, etc.) on the reaction between ammonium sulfate and glyoxal at changing alcohol concentration and temperature. The main purpose of our research was to observe the temperature dependence of the reactions between 3.0 M ammonium sulfate, 0.095 M glyoxal, and 0.00M-1.00 M of an alcohol. Reactions were performed by mimicking the aerosols in bulk, aqueous solution which included ultrapure water, ammonium sulfate, glyoxal, and one of the alcohols. Long-term light spectroscopy readings were taken on a Thermo UV-Visible Spectrophotometer over periods of time ranging from approximately 24-72 hours and at different temperatures in order to map the change in light absorbance over time. Thus far we have determined that reactivity within the system increases as both concentration and temperature increase.

Additionally, solutions were made with another group of alcohols; 1,3-propanediol, 1,2-propanediol, 1,4-butanediol, acetone, and acetonitrile. These alcohols are also prevalent in the atmosphere, and the aqueous solutions were prepared in a similar way to that of the thermodynamics solutions. The viscosity, pH, and light absorbance over time were measured for these solutions. Further research needs to be conducted to better understand the results of the pH and viscosity experiments. The data collected in these experiments could potentially be used to understand the kinetics of SOA formation under similar conditions in a non-controlled environment.

References:
Yi, Y., Cao, Z., Zhou, X., Xue, L., & Wang, W. (2018). Formation of aqueous-phase secondary organic aerosols from glycolaldehyde and ammonium sulfate/amines: A kinetic and mechanistic study. Atmospheric Environment, 181, 117-125.

Advisor: Andrew Berke, Chemistry

SURF 2018-Post SURF Survey

Name	Morgan Jones
Year of Graduation	2021

Are you in a Graduate program?	no
SURF Advisor	Paramjeet Pati, Engineering
Advisor Department	Engineering
SURF Field of Study	Engineering and design
Title of Abstract/Research	Water Stressed Cites of the Future

Please type your abstract below.

Water scarcity touches approximately one-third of the population. With continued usage patterns, water stress is predicted to spread its impact to half the world's population by 2030. Increasing demands on water, due to rapidly multiplying cities and a changing climate, decreases the resilience of cities against water shortages. By 2050, nearly 70% of the world's population will reside in urban areas, where 60% of the space is unestablished. This means most of the world's future cities are yet to be built. Current cities have the potential to bring insight to changes expected for the world's future. By observing spatial data and deconstructing water challenges with intersected social, economic, environmental, and health constraints; I compared trends in dynamic world cities to identify resilient and sustainable approaches for water management.

Water scarcity is triggered by climate change, drought, pollution, destruction of ecosystems, agriculture, geography, political and social unrest, governmental access, and overuse. Poor health, lack of education, diseases, inadequate hygiene, and poverty prolong the reduced access to freshwater from marginalized groups. Since governments do not prioritize issues that affect uninfluential constituencies, low income and underrepresented parties continue to suffer from water scarcity. Racial and economic divisions are amplified by freshwater availability, quality, and volume. People stay home due to malnourishment and sickness or are forced to collect water from long distances. This keeps mainly women and young girls away from the education system and opportunities for upward mobility. Industrial chemicals, pharmaceutical drugs, herbicides, nutrient imbalances, and other pollutants entering waterways and drinking water spread quickly due to the cyclic nature of water, causing major health issues in populations and their corresponding geographic ecosystems. Increasing population demand for water, creates more centralized wealth in cities. Higher incomes tend to indulge more in water intensive products, including meat and fossil fuels. Global water requirements are predicted to increase by 50% due to increased food demands for an exponentially expanding population. Therefore, cities are a breeding ground for water stressors. A variety of approaches are needed as geography, climate, population demographics, and other water stressors shift.

Regenerating natural infrastructure (green spaces) in cities increases water reserves by recharging groundwater and decreasing flood risks, repairing and maintaining leakage in crumbling infrastructure improves the efficiency of water usage, establishing water recycling recovers precious freshwater, and adapting to sustainable policies can improve health, sanitation, pollution, and the effects of environmental degradation in cities.

SURF 2018-Post SURF Survey

Name	Jessica Bonsu
Year of Graduation	2021

Are you in a Graduate program?	no
SURF Advisor	Sarah Moore, Engineering
Advisor Department	Engineering
SURF Field of Study	Protein Engineering
Title of Abstract/Research	Engineering Proteins to Cross Blood Brain Barrier
Please type your abstract below.	The Blood Brain Barrier (BBB) prevents damaging substances and materials from entering the Central Nervous System (CNS). Although the BBB plays an important role in keeping the CNS stable, it also prevents drugs from entering the CNS to treat disorders such as Alzheimer's and Huntington's disease. Professor Sarah Moore's lab focuses on engineering proteins that can transfer drugs into the CNS that will have therapeutic and diagnostic effects on central nervous system diseases. We have used the internalization pathway of an iron-carrying proten, transferrin, which binds to the transferrin receptor, to design a strategy to transport drugs into the CNS. We are engineering proteins to mimic the natural internalization pathway of transferrin by binding to the transferrin receptor and subsequently delivering drugs to the CNS through the BBB. Specifically, this summer, my labmate, Basira Daqiq, and I worked to improve the expression and solubility of proteins that were previously engineered to bind to the transferrin receptor. To do this, we worked on attaching C-myc and Cys peptide tags to our engineered protein scaffold, Fibronectin Type III (Fn3). We added the tag to the C-terminus (the end) of the Fn3 protein to prevent any disturbance to the binding properties of our engineered protein. We successfully used recombinant DNA methods to generate all engineered protein variants with the C-myc and Cys tags. Our preliminary results indicate that our modified proteins can be expressed in bacteria, but that the proteins still present difficulties with solubility, which will be addressed during continued research.

SURF 2018-Post SURF Survey

Name	Daniel Wood **Smith**
Year of Graduation	2019

Are you in a Graduate program?	no
SURF Advisor	Sara Pruss, Geosciences
Advisor Department	Geosciences
SURF Field of Study	Benthic foraminifera of Shark Bay Australia - Diversity, Abundance, and Early Diagenesis
Title of Abstract/Research	Ecology and Taphonomy of Benthic Foraminifera from Shark Bay, Western Australia
Please type your abstract below.	Shark Bay, Western Australia, is considered a naturally stressed environment due to extreme summer temperatures and hypersalinity as high as 60 ppm, almost twice the salinity of normal marine settings. The sediment communities are composed of microbes, bivalves, diatoms, green algae, gastropods, foraminifera and crustaceans. The sediments are low in quartz grains and are not muddy. This study seeks to document the benthic foraminiferal diversity, abundance, and carbonate contribution to the sediments of Carbla Beach, located in the Hamelin Pool. All samples were found to be rich in benthic foraminifera, with the four most abundant species being Peneroplis planatus, Peneroplis pertuses, Dendritina striata, and Spirolina sp. Deformities were found primarily in the most common species, with abnormal chamber arrangement, repositioning of the aperture, and modifications to coiling types being the most common type of test deformation. The benthic foraminifera at this study location were found to have a high abundance of tests with a low diversity of species. The total number of species recorded was about 25 unique species. Along the underwater transect, a trend was found with increasing foraminifera tests closer to the beach. In one gram of each sample point along the underwater transect, Point 4 had the greatest abundance of 5,397 tests and Point 1 had a total count of 1,906 tests. Just a few centimeters below the sediment-water interface, the white carbonate sands turn black with pyrite. Around 3% of the grains were found to have some level of pyrite replacement of calcite, indicating the presence of microbial sulfate reducers and abundance dissolved iron in the water. Pyritized grains were the most common in the 250 and 180 size fractions, making up close to 30 percent of the foraminiferal weight (g).

SURF 2018-Post SURF Survey

Name	Kate Fessler **Smith**
Year of Graduation	2018

Are you in a Graduate program?	no
SURF Advisor	Steven Williams, Biological Sciences
Advisor Department	Biological Sciences
SURF Field of Study	Biological Sciences
Please list co-authors of your abstract	Beck Bloomfield, Kalani Williams
Title of Abstract/Research	Development of a Species-Specific Quantitative PCR Diagnostic Assay for the Sea Lion Lungworm Parafilaroides decorus

Please type your abstract below.

In 2017 approximately 1,000 California sea lions, Zalophus californianus, were stranded in Southern California. Many arrive at rehabilitation centers with parasitic infections (Felix, 2013). A common lung parasite, Parafilaroides decorus, causes symptoms such as anorexia, coughing, dyspnea, and blood in the waste (Dailey, 1970). Infections cause high mortality and can be difficult to diagnose. To assess the threat posed to sea lions, rehabilitation facilities must be able to diagnose and apply targeted treatments to living animals.

We receive lungworm samples that have been contextually and morphologically identified by The Marine Mammal Center in Sausalito, California. We perform barcoding PCR to molecularly identify these nematodes, relying on the information in NCBI's BLAST database. The database compares new sequences to the genomes
already present in the database. Unfortunately, there are limited sequences of few loci from P. decorus in the NCBI database, limiting our identification to the genus level. Barcoding protocols are also not sensitive enough to identify nematodes in samples of feces and sputum. The goal of the project was therefore to utilize whole-genome, next-generation sequencing of these nematodes to create a sensitive and species-
specific repeat-based quantitative PCR assay to identify and diagnose P. decorus infections from noninvasively collected samples.

Once we sequenced the P. decorus genome, we used RepeatExplorer software to design species-specific primers and probes based on the non-coding repeats present in the P. decorus genome. I spent several weeks optimizing the assay for the detection of P. decorus using whole worm DNA isolations, then tested the efficacy of the assay using DNA extractions from samples of sea lion feces. This helped to determine whether a P. decorus infection could be easily detected in noninvasively collected fecal samples.

Results were mixed: the P. decorus assay was successful and detected P. decorus DNA down to a concentration of 0.00000001 ul/ ng. However, the assay was so sensitive that it was unclear whether the fecal extraction results were positive because of contamination, trace DNA from the sea lion's diet, or a true infection. The types of DNA present in a fecal sample are so varied (including DNA from the host, parasites,
fish, bacteria, etc.) that we concluded feces is not a viable candidate for screening infections. Future directions for use of the assay include testing sputum/nasal swabs, as we hypothesize that sputum contains parasite DNA without ancillary DNA from the sea lion's diet.

SURF 2018-Post SURF Survey

Name	Haleigh Anderson
Year of Graduation	2019

Are you in a Graduate program?	no
SURF Advisor	Alex Barron
If your SURF Advisor was not listed above you can enter their name here.	
Advisor Department	Environmental Science and Policy
SURF Field of Study	Environmental Science and Policy
Title of Abstract/Research	Retrospective Analysis of the Mercury and Air Toxics Standards Compliance Strategies

Please type your abstract below.

Electricity generation in the United States relies on coal- and oil-fired electric generating units (EGUs) which emit hazardous air pollutants (HAPs) such as mercury and particulate matter. Mercury is a neurotoxin that is of particular concern because of the risk it poses to developing fetuses and children (1). In 2005, coal fired EGUs accounted for nearly half of all anthropogenic sources of mercury in the nation. And despite a general movement away from coal, in 2017 coal accounted for roughly 30% of US electricity generation (3). As a regulatory agency, the Environmental Protection Agency (EPA) must therefore balance reducing emissions from coal generation while ensuring that regulations are not too stringent for an essential industry.

The Mercury and Air Toxics Standards issued by EPA regulate pollutants from coal- and oil-fired power plants, including mercury and particulate matter. When the regulation was proposed in March 2011, utilities across the country raised concerns about costs and bringing older plants into compliance. When the rule was issued, MATS was one of the most expensive rules ever promulgated by the agency, with the EPA estimating the cost to utilities to be about $9.6 billion for 2015 (4). My hypothesis is that capital cost estimates, retirement projections related to environmental compliance and/or MATS compliance will decline over time as utilities became more familiar with the rule and adjustments were made by the agency. This SURF project analyzed annual filings from electric utilities, financial data, and other data sources to determine how cost estimates from utilities changed between 2009 and 2017 to evaluate the impact of MATS.

My work over the summer focused on constructing a list of utilities to study, compiling a dataset, and learning the regulatory structure behind MATS and similar regulations. While we are still reviewing the data we found that only 7 of 30 utilities specifically mentioned MATS compliance costs in annual filings. My honors thesis will continue this project, with the goal of providing useful data in the development and implementation of environmental regulations.

(1) Schierow, L.-J. (2004). Mercury in the Environment: Sources and Health Risks, 29.

(2) Mercury and Air Toxics Standards (MATS). (2017, September 27). Retrieved July 31, 2018, from http://environment.law.harvard.edu/2017/09/mercury-air-toxics-standards-mats/

(3) What is U.S. electricity generation by energy source? (2018, March 7). Retrieved July 16, 2018, from https://www.eia.gov/tools/faqs/faq.php?id=427&t=3

(4) Regulatory Impact Analysis for the Final Mercury and Air Toxics Standards (2014). Retrieved from https://www3.epa.gov/ttn/ecas/regdata/RIAs/matsriafinal.pdf

SURF 2018-Post SURF Survey

Name	McKayla Ford **Smith**
Year of Graduation	2020

Are you in a Graduate program?	no
SURF Advisor	Steven Williams, Biological Sciences
Advisor Department	Biological Sciences
SURF Field of Study	Biological Sciences
Title of Abstract/Research	Unc-86 Protein and Mec-3 Promoter Production and Binding

Please type your abstract below.

Lymphatic Filariasis, a neglected tropical disease also known as elephantiasis, causes inflammation of the lymphatic system, pain, and sometimes disability, and threatens more than 856 million people in 52 countries[1]. One cause of Lymphatic Filariasis is Brugia malayi, a parasitic helminth. While some successful preventative measures have been developed, the possibility of the parasite developing resistance and of side effects from the treatments means it is important to develop new approaches to anti-parasitic drug design.

A previous research project determined that a potential drug target in B. malayi would be the transcription factor UNC-86, and its associated promoter, mec-3. In C. elegans, the UNC-86 and mec-3 pairing regulates neuronal development[2], but it is unknown whether or not the pairing serves the same purpose in B. malayi. This project aimed to investigate the binding of UNC-86 and mec-3 in vitro.

To investigate the binding of UNC-86 and mec-3, both the promoter and the protein needed to be produced. Previously, UNC-86 was cloned into competent E. coli cells using the pMAL expression plasmid vector from New England Biolabs. These cells were grown, induced, and lysed, and the resulting extract was purified via affinity purification and Factor X cleavage to yield UNC-86 protein. Additionally, PCR was performed on genomic B. malayi DNA to amplify the mec-3 promoter, which was then reamplified to produce purer, more concentrated PCR products, both with and without a biotin tag for later visualization. We used ethanol precipitation to concentrate the promoter DNA and to clean it for the protein/promoter binding assay. Due to degradation of the stock PCR primer solutions, production of the DNA was impure and had a relatively poor yield.

Next semester new primers will be used to produce enough DNA to perform the binding assays. The binding of the mec-3 promoter region will be tested through the electrophoretic mobility shift assay (EMSA) and the DNAse I footprinting assay, which will confirm binding of the protein to the DNA, will allow rough quantification of the binding, and will facilitate mapping of the UNC-86 binding sites in the mec-3 promoter.

1.WHO: Lymphatic filariasis. 2017.
http://www.who.int/mediacentre/factsheets/fs102/en/ (Accessed July 30, 2018)
2. Sze JY, Zhang S, Li J, and Ruvken G. "The C. elegans POU-domain transcription factor UNC-86 regulates the tph-1 tryptophan hydroxylase gene and neurite outgrowth in specific serotonergic neurons." Development 129: 3901-11. 2002.

SURF 2018-Post SURF Survey

Name	Alisha Shrestha
Year of Graduation	2019

Are you in a Graduate program?	no
SURF Advisor	Cristina Suarez, Chemistry
Advisor Department	Chemistry
SURF Field of Study	DNA
Please list co-authors of your abstract	Chhiring Lama and Ruby Wu
Upload image(s) in .png format; 1,100 MB max size each	
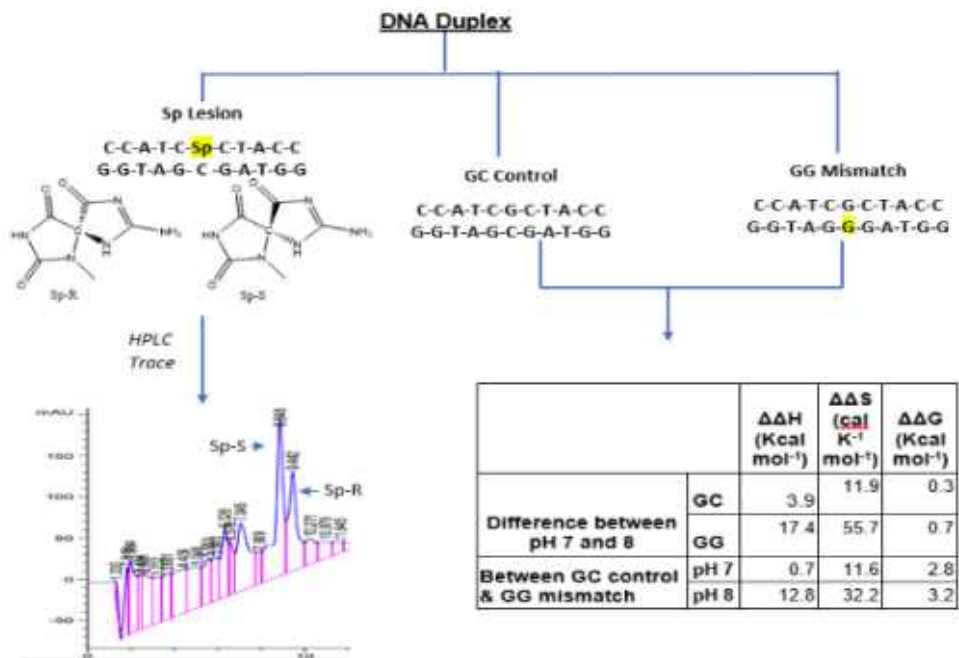
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Title of Abstract/Research	Spiroiminodihydantoin Lesion Synthesis and Analysis of Thermodynamic Stability of Mismatched DNA Using UV/Vis Spectroscopy

Please type your abstract below.

DNA contains the genetic information needed to sustain life. When DNA is damaged, cancer and neurodegenerative diseases can result. This summer, we investigated two different types of DNA damage. The first type, the spiroiminodihydantoin (Sp) lesion, forms when a guanine nucleobase is oxidized. The second type of damage investigated was the effect of having a DNA mismatch (a non-Watson-Crick base pairing partner) on the DNA duplex. The thermodynamic stability (ΔH, ΔS and ΔG) of mismatched versus normal DNA was calculated using data acquired through melting temperature (Tm) experiments on a UV-Vis spectrophotometer. The major findings from these experiments are shown in Figure 1 and will allow us to better understand how mismatches affect the stability of DNA duplexes.

In preparation for 2-D NMR Nuclear Overhauser Effect Spectroscopy (NOESY) studies comparing control and damaged DNA, an 11-mer DNA strand containing 8-oxo-guanine was oxidized using sodium persulfate and sodium bicarbonate. The two diastereomeric lesions, Sp1 and Sp2, were identified using mass spectrometry, collected, and purified using HPLC, giving a yield of 46%. The material collected will be used for future NMR experiments on Sp lesion containing DNA duplexes

SURF 2018-Post SURF Survey

Name	Leah Tallent **Smith**
Year of Graduation	2019

Are you in a Graduate program?	no
SURF Advisor	Robert Newton, Geosciences
Advisor Department	Geosciences
SURF Field of Study	Geosciences

1.png

2.png

Title of Abstract/Research   Sediment Sluicing Experiment in Paradise Pond, Northampton, MA

Please type your abstract below.

Sediment accumulation has been an ongoing issue in Paradise Pond, where the accumulation rate of approximately 2000 cubic yards per year requires periodic dredging to keep the water depth needed for recreational activities. In previous decades sediment was removed by dry dredging and the sediment was transported to the Northampton Landfill. This is no longer a practical option as the closing of the landfill has made this prohibitively expensive. In addition, it is now recognized that removal of sediment may lead to downstream sediment starvation that is harmful to the downstream ecosystem.

The proposed, less costly solution, is to sluice the sediment out of the pond during high flow events. This involves sending sediment that has built up in the pond out through the sluice gate at the base of the dam. Sediment is mechanically moved to the base of the dam during a partial pond drawdown using a small bulldozer to push accumulated sediment from the upstream parts of the pond into the river flowing through the pond bottom during the drawdown. This river then moves the sediment to the pond area just upstream of the dam.

A sluicing experiment was conducted in late June of 2018 to test the viability of removing sediment from the area just upstream of the dam by sluicing. A 3.23in rain event on 6/27/18 caused the discharge of the Mill River at the Lamont Bridge to increase to approximately 880cfs (Figure 1). The sluice gate at the base of the dam was opened from just prior to peak flow to just after peak flow (Figure 1). Bathymetric data from the pond just upstream of the dam, was collected before and after the event using a RiverRay ADCP (Acoustic Doppler Current Profiler). Two Digital Elevation Models (DEMs) of the pond bottom were created using ESRI ArcMap 10.6 software to model pre and post sluice event bottom elevations (Figure 2). The volume of sediment removed from the pond bottom during sluicing can be estimated by comparing the pre and post sluice DEMs. The post sluice DEM is first subtracted from the pre sluice DEM and the resulting raster is multiplied by the DEM cell size. Integrating the resulting difference raster yields the total volume of sediment removed, which in this case was approximately 110m3.

Three moving bed tests were also conducted with the RiverRay ADCP during this storm event. These tests, analyzed using WinRiver II software, directly measure the velocity and direction of sediment moving along the pond bottom. The first test indicated bottom sediment moving at 2.8cm/s, the second showed the sediment moving at 1.1cm/s, and the third test showed the sediment moving at 0.7cm/s. These tests show that bottom sediment was moving during the sluice test and that sluicing can be successful even at the relatively low discharge of 880cfs.

SURF 2018-Post SURF Survey

Name	Raegan Stokes
Year of Graduation	2019

Are you in a Graduate program?	no
SURF Advisor	Michael Baressi, Biological Sciences
Secondary SURF Advisor	Naren Pathak
Advisor Department	Biological Sciences
SURF Field of Study	Neuroscience
Title of Abstract/Research	What is the role of meteorin in the developing embryo and how do these developmental patterns correlate to Autism Spectrum Disorder?

Please type your abstract below.

METRN is a gene that causes the secretion of a protein called meteorin, a neurotrophic factor which functions outside of the cell. Meteorin has known expression in undifferentiated neural progenitors, radial glia and cells of the astrocyte lineage. It has been shown in mice cell cultures that meteorin promotes astrocyte formation from neuronal precursor cells and induces cerebellar astrocytes to become radial glia. Meteorin has also been shown to incite "axonal extension in small and intermediate neurons of sensory ganglia by activating nearby satellite glia". (Nishino et al. 2004) Cerebellar radial glia function as neuronal progenitors and play an important role in early brain development scaffolding for the migration of cells. The transportation factors in radial glia also aid in gyrification.

Meteorin has been listed as a dysregulated gene in developmental ASD (Geschwind D. and Voineagu I. 2014) and as a gene associated with ADHD which has high comorbidity with ASD (NBIGN Modules 2015). Autism is characteristic of cerebellum changes. (Bauman M. 2015) Meteorin turns cerebellar astrocytes into radial glia (Weizmann Institute of Science 2015). Since, there are no known astrocytes in zebrafish, the radial glia act as the primary neuroglial cells. This means that they aid in the blood brain barrier as astrocytes in humans do.

To study the relationship between metrn and ASD, we created a metrn knockout using CRISPR technology in zebrafish. Recently, our crispr mutation has been sequenced to be a 4bp insertion. With these mutant fish, I have spent the summer using immunohistochemical staining to visualize axons, radial glia, proliferation and cell death in the developing zebrafish brain from 24 hpf to 56 hpf. This allows us to examine whether mutants exhibit defects of proliferation, differentiation and/or migration in specific types of cells. No quantitative data has been collected yet.

The next steps in the project are to repeat these immunohistological staining experiments to characterize and refine a morphological phenotype in the metrn mutant, as well as conduct in situ hybridization experiments to visualize the expression pattern of metrn in the developing wild type embryo.

SURF 2018-Post SURF Survey

Name	Lydia Pedrick DeAngelo DeAngelo
Year of Graduation	2019

Are you in a Graduate program?	no
SURF Advisor	Steven Williams, Biological Sciences
Secondary SURF Advisor	Kevin Shea
Advisor Department	Chemistry
SURF Field of Study	Biochemistry
Title of Abstract/Research	Testing the Toxicity and Mutagenicity of Sesquiterpene Lactones from Neurolaena lobata as Potential Drugs for Treating Neglected Tropical Diseases

Please type your abstract below.

Lymphatic filariasis is a neglected tropical disease that affects over 120 million people in areas across Asia, Africa, the Pacific and the Americas. The disease is caused by parasitic nematodes, Wuchereria bancrofti, Brugia malayi, and Brugia timori. These nematodes live in the human lymph nodes and cause chronic conditions such as lymphoedema and elephantiasis. Current drug treatments target the larval stages, but do not kill adult parasites. The Shea Lab and Williams Lab have been in collaboration to develop new treatments for LF by isolating and modifying compounds from the medicinal plant N. lobata. To date, neurolenin B and acetylated derivatives of neurolenin have demonstrated the most significant antifilarial activity against adult B. pahangi at concentrations as low as 3 ug/mL. My research this summer has been to evaluate both the toxicity of Neurolenin B and its potential mutagenic effects in hopes of furthering it as a potential drug candidate against LF.

Hepatic cell lines are commonly used for toxicity testing due to their drug metabolizing functions and ability to demonstrate overall cytotoxicity. HepaRG is a unique immortalized cell line that maintains functionality similar to primary hepatocytes, without compromising the cells ability to proliferate. The MTT assay is one of the most universally used analyses in toxicity testing. It is colorimetric assay based on the metabolic reduction of MTT to formazan by an NADH-dependent cellular oxidoductase. Cells with little metabolic activity reduce small amounts of MTT, while healthy cells form larger amounts of formazan during the assay.

The Ames test is the most universally accepted biological assay used to determine mutagenicity for a given compound. Several mutant strains of S. typhimurium are used that cannot produce the essential amino acid histidine. The procedure is based on culturing these strains with the test compound in his-medium and measuring the amount of revertant colonies under these conditions. Mutagenicity is indicated by high number of colonies growing in his- media, meaning that mutations must have occurred. The assay is completed both with and without metabolic activation using the rat liver enzyme S9 in addition to strain specific positive and negative controls.

Completion of the toxicity and mutagenicity testing will continue in the fall as well as further culturing of the B. pahangi nematodes with different derivatives of neurolenin. The project will also move forward with testing neurolenin B on soil transmitted helminth parasites in collaboration with the University of Massachusetts, Amherst.

SURF 2018-Post SURF Survey

Name	Katie McCann **Smith**
Year of Graduation	2021

Are you in a Graduate program?	no
SURF Advisor	Judith Cardell, Engineering
Advisor Department	Engineering
SURF Field of Study	Electrical Engineering
Title of Abstract/Research	The Reliability of Demand Response
Please type your abstract below.	In the US, in order for the electrical grid to function most optimally, power companies must keep the current at a steady 60 Hz. A deviation of only 0.5 Hz from the ideal will result in necessary load shedding to maintain optimal frequency. To keep the grid running properly, power companies must constantly make adjustments in their supply to meet demand. At peak demand periods, when the power company is reaching their max capacity, it becomes necessary to get creative. Demand response programs provide one method of controlling demand during peak periods. In essence demand response is where a consumer, usually a large commercial business, reduces their load during peak demand periods in exchange for financial incentives. If these programs are successful they have potential to be used in combination with wind energy. To determine how effective these programs are, we have been collecting data from the six main independent system operators (ISO) in the US; CAISO, ERCOT, ISOne, MISO, NYISO, and PJM. By comparing their popularity, cost effectiveness, and convenience, we can hypothesize whether or not these programs can be a successful long term solution to fluctuations in wind energy.

SURF 2018-Post SURF Survey

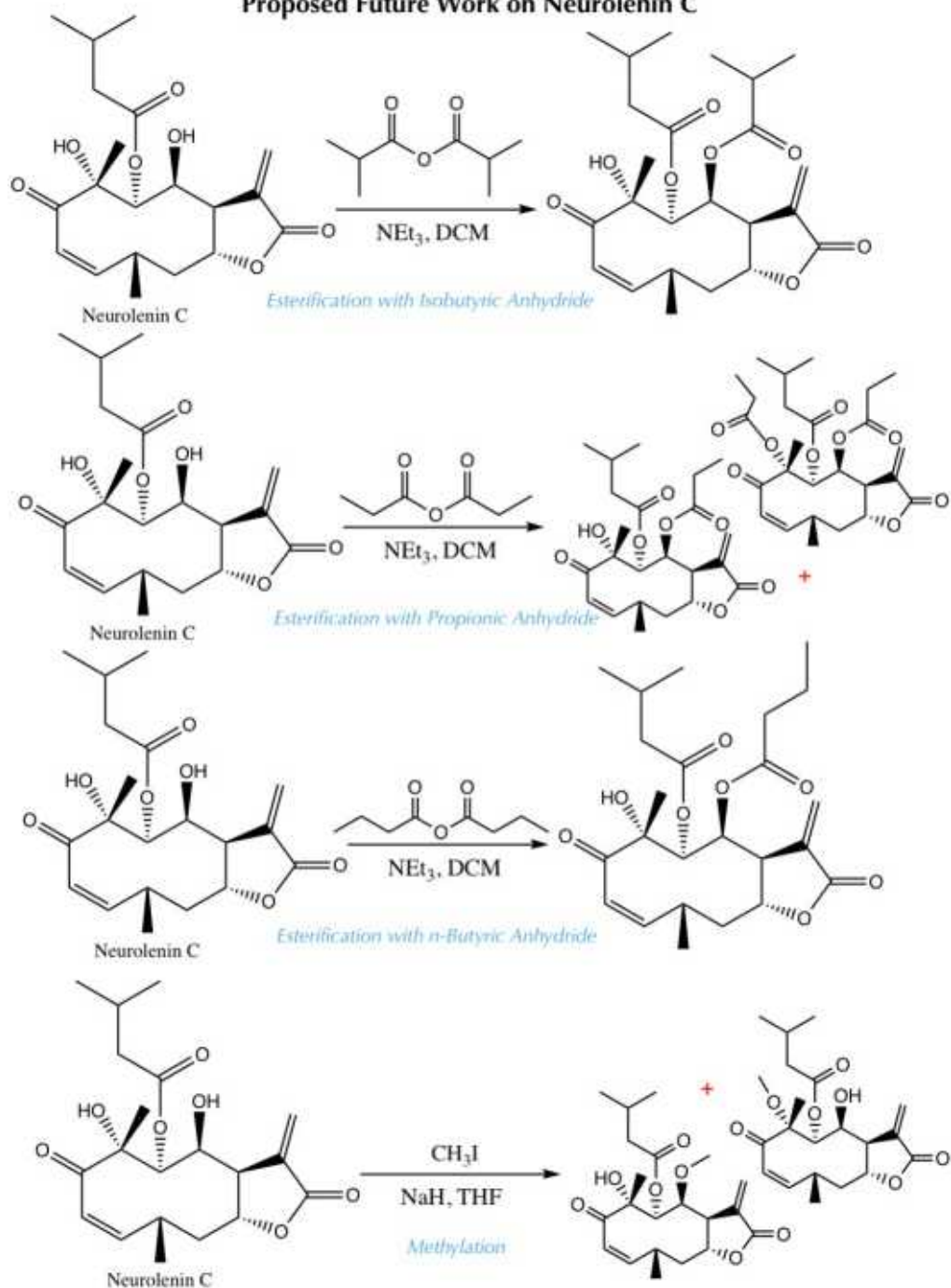|	
Name	Florence Zhang
Year of Graduation	2020
Are you in a Graduate program?	no
SURF Advisor	Kevin Shea, Chemistry
Advisor Department	Chemistry
SURF Field of Study	Organic Chemistry
Upload image(s) in .png format; 1,100 MB max size each	
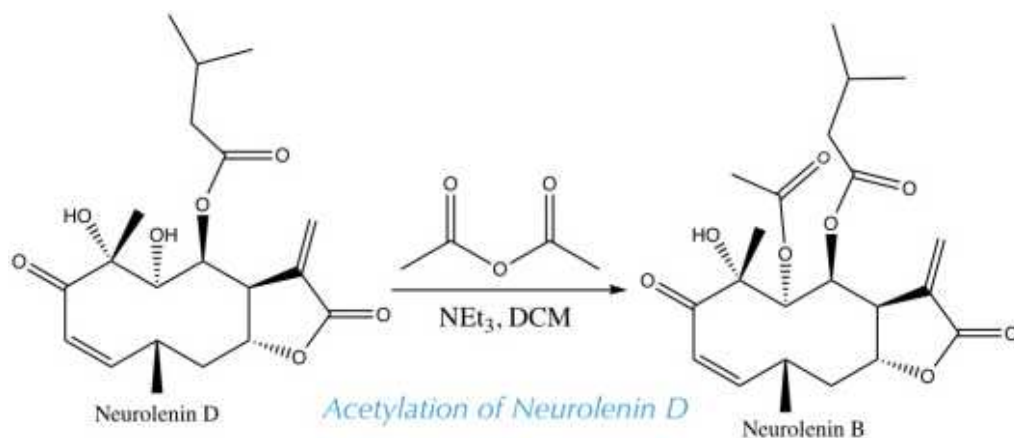
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Proposed Future Work on Neurolenin C

FZ-figure 1.png

| **Title of Abstract/Research** | Extraction and Purification of Neurolenins from Neurolaena lobata |

Please type your abstract below.

Neurolenins are a group of compounds extracted from Neurolaena lobata, a plant that grows in South and Central America. Previous studies have demonstrated that neurolenins, especially neurolenin B, have significant anti-filarial activity against nematodes that cause lymphatic filariasis (LF). According to the WHO fact sheet for lymphatic filariasis, over 856 million people in 52 countries are threatened and over 120 million people were infected in 2000. Treatment for lymphatic filariasis is limited because it is only effective on the parasite larvae, not the adult. The goal of this project was to chemically create analogs of naturally occurring neurolenins and test them against Brugia malayi, one of the species that cause LF. However, the supplier of the nematodes failed to provide samples due to technical problems. Therefore, the goal of this summer was to prepare more pure samples of neurolenin B for testing on other parasites and prepare pure samples of neurolenin C and its derivatives.

At first I attempted to isolate neurolenin B from crude extraction which normally includes neurolenin B, neurolenin D and other impurities via flash column chromatography. However, after collecting several column products and recrystallizing, the 1H NMR and 13C NMR showed that the crystals are indeed neurolenin C. This is the first time in our lab that neurolenin C was directly separated and purified from Neurolaena lobata leaves. Previously, neurolenin C was produced through a transesterification of neurolenin D. Separation of neurolenin C and D (isomers of each other) with flash column chromatography was very difficult. About 200mg of pure neurolenin C was produced this summer for further modification and testing. Proposed reactions that can be run on neurolenin C include esterification with isobutyric anhydride, n-butyric anhydride and propionic anhydride and methylation of the secondary alcohol with methyl lithium and sodium hydride. (Figure 1). Neurolenin B was then produced through an acetylation reaction of neurolenin D and acetic anhydride (Figure 2). Samples were stored for further testing against parasites.

Figure 1. Proposed Possible Reactions on Neurolenin C

Figure 2. Preparing Neurolenin B

SURF 2018-Post SURF Survey

Name	Jiachen Yan **Smith**
Year of Graduation	2019

Are you in a Graduate program?	no
SURF Advisor	Benita Jackson, Psychology
Advisor Department	Psychology
SURF Field of Study	Social/personality/health psychology
Please list co-authors of your abstract	Benita Jackson, Shanila Sattar, Caroline Li, Jiachen Yan
Title of Abstract/Research	Meta-analytic Evidence Linking Self-Objectification and Health Behaviors
Please type your abstract below.	Description of the question: Self-objectification the viewing of one's body primarily from an outsider's perspective. This seemingly innocuous phenomenon has been linked to a host of health compromising behaviors including dysregulated eating, substance use, and risky sexual behavior. These links are mediated through affective processes, particularly shame, but also include anxiety, depression, and neuroticism among others. But a systematic, comprehensive systematic analysis of the scope of associations between self-objectification and health behaviors has not yet been done. Participants: N = 19,095 in 89 correlational samples and 7 experimental samples across 62 independent studies, including females and males over the lifespan, from both published studies and dissertations through January 2016. Design and Methods: Meta-analyses of the association between self-objectification and health behaviors, specifically: dysregulated eating, sexual experiences, contraceptive use/sexually-transmitted infection (STI) prevention, substance use, exercise, and food consumption, and moderator analyses by demographics. Results: Self-objectification showed a moderate association with health risk behaviors generally (d=.61 fixed-effects; d=.38 random-effects). Within health behavior types, effect sizes ranged from modest [sexual experiences, substance use, food consumption, exercise, and contraceptive use/STI prevention, to large [dysregulated eating]. Gender was a key moderator, with effects amplified for females. Notably, not a single sample demonstrated that higher self-objectification was linked to salubrious health behaviors. Self-objectification may broadly predict health behavior risk, and interventions to reduce self-objectification could have a wide cost-effective outcomes. Meta-analyses of experimental data as they accrue are warranted to test this claim.

SURF 2018-Post SURF Survey

Name	Caroline Li
Year of Graduation	2020

Are you in a Graduate program?	no
SURF Advisor	Benita Jackson, Psychology
Advisor Department	Psychology
SURF Field of Study	Social/personality/health psychology
Please list co-authors of your abstract	Benita Jackson, Shanila Sattar, Caroline Li, Jiachen Yan
Title of Abstract/Research	Meta-analytic Evidence Linking Self-Objectification and Health Behaviors

Please type your abstract below.

Description of the question: Self-objectification the viewing of one's body primarily from an outsider's perspective. This seemingly innocuous phenomenon has been linked to a host of health compromising behaviors including dysregulated eating, substance use, and risky sexual behavior. These links are mediated through affective processes, particularly shame, but also include anxiety, depression, and neuroticism among others. But a systematic, comprehensive systematic analysis of the scope of associations between self-objectification and health behaviors has not yet been done. Participants: N = 19,095 in 89 correlational samples and 7 experimental samples across 62 independent studies, including females and males over the lifespan, from both published studies and dissertations through January 2016. Design and Methods: Meta-analyses of the association between self-objectification and health behaviors, specifically: dysregulated eating, sexual experiences, contraceptive use/sexually-transmitted infection (STI) prevention, substance use, exercise, and food consumption, and moderator analyses by demographics. Results: Self-objectification showed a moderate association with health risk behaviors generally (d=.61 fixed-effects; d=.38 random-effects). Within health behavior types, effect sizes ranged from modest [sexual experiences, substance use, food consumption, exercise, and contraceptive use/STI prevention, to large [dysregulated eating]. Gender was a key moderator, with effects amplified for females. Notably, not a single sample demonstrated that higher self-objectification was linked to salubrious health behaviors. Self-objectification may broadly predict health behavior risk, and interventions to reduce self-objectification could have a wide cost-effective outcomes. Meta-analyses of experimental data as they accrue are warranted to test this claim.

SURF 2018-Post SURF Survey

Name	Sarah Chin
Year of Graduation	2019

Are you in a Graduate program?	no
SURF Advisor	Paulette Peckol, Biological Sciences
Advisor Department	Biological Sciences
SURF Field of Study	Marine Science
Please list co-authors of your abstract	Katelyn Smalley
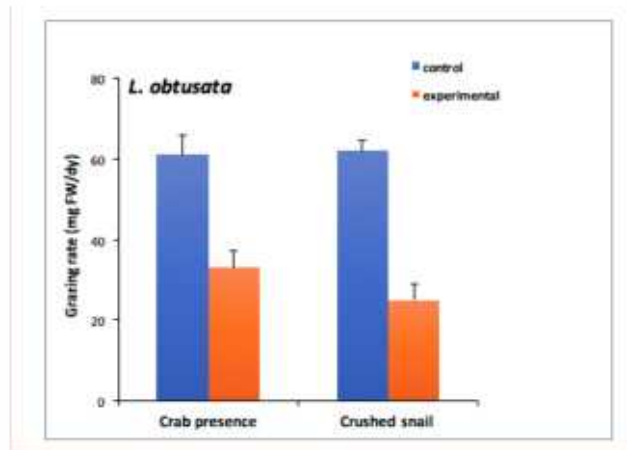
Fig.1. Mean ($\pm$SE) grazing rate (mg FW/dy) of *L. obtusata* in the presence of *C. irroratus* (crab presence) and crushed conspecifics (*L. obtusata*). Grazing rate on *F. vesiculosus* was reduced significantly under both experimental treatments when compared with control rates.

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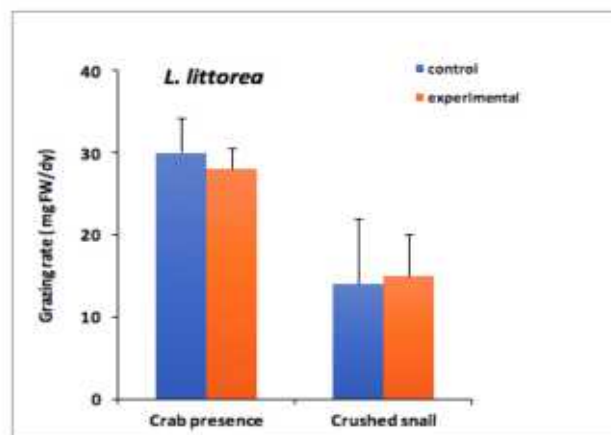
Fig. 2. Mean ($\pm$SE) grazing rate (mg FW/dy) of *L. littorea* in the presence of *C. irroratus* (crab presence) and crushed conspecifics (*L. littorea*). Grazing rate on *F. vesiculosus* did not vary significantly between control and experimental treatments.

Screen Shot 2018-09-03 at 11.29.07 PM.png

Title of Abstract/Research

The Great Escape: behavioral evasion adaptations of herbivorous gastropods Littorina littorea and L. obtusata in the presence of their predators, invasive Hemigrapsus sanguineus and Carcinus maenas, and native Cancer irroratus

Please type your abstract below.

Predator-prey interactions can shape the behavior and livelihood of intertidal populations. In New England, the invasive predators, Carcinus maenas (Green Crab) and Hemigrapsus sanguineus (Asian Shore Crab), have an impact on grazing rates of Littorina obtusata and L. littorea. Past research in this lab found that grazing rates of L. littorea decreased only in the presence of C. maenas, while herbivory of L. obtusata decreased significantly in the presence of both invasive crabs. We expanded this research to include the effect of native crab, Cancer irroratus (Rock Crab), and the presence of crushed snail conspecifics on herbivory. We found that Rock Crabs did not consume either gastropod species in the lab; however, the presence of this predator significantly reduced herbivory of L. obtusata ($t = 4.3$, $P = 0.007$) but not L. littorea (Figs. 1, 2). Crushed conspecifics (L. obtusata) elicited a similar depression of grazing ($t = 2.75$, $P = 0.015$) by L. obtusata.

We then examined the potential for an escape in size by the gastropods. H. sanguineus was unable to consume L. littorea collected from the Jamestown, RI site, while C. maenas consumed a few smaller L. littorea. We conclude that L. littorea may achieve a size refuge above ~9 mm. In contrast, both invasive crab predators consumed L. obtusata, and this gastropod could not reach a size refuge at this site from Green Crab. L. obtusata did achieve escape in size above ~12 mm from predation by Asian Shore Crab.

In the field, L. obtusata consistently occur in greater densities in high intertidal areas, compared with mid- and low intertidal zones. Further, larger individuals tend to be found in the lower regions. Given their vulnerability to predation highlighted in our lab experiments, we hypothesized that the species' distribution pattern might be affected by the presence of crab predators in the low intertidal and shallow subtidal areas. We took quadrat data to census initial densities of L. obtusata and selected areas with similar ($t = 1.04$, $P = 0.31$) snail abundances. To one area, we added H. sanguineus to achieve ~5X higher crab densities than usually found at this site, and left the other area as a control. We found a marginal effect of H. sanguineus addition. Although there was not a significant change in abundance in the control area, L. obtusata had a 52% reduction in density in the crab addition area ($t = 1.79$, $P = 0.09$). In contrast, L. littorea showed no significant change in abundance following crab addition. This short-term field experiment supports our lab work in highlighting impacts of crab predators on L. obtusata grazing activity and distribution. We conclude that crab predators place L. obtusata in a continuous state of vulnerability because of its smaller size compared with L. littorea, and thus might contribute to its limited distribution and herbivory in rocky intertidal areas.

SURF 2018-Post SURF Survey

Name	Aleice Goodman
Year of Graduation	2019
Are you in a Graduate program?	no
SURF Advisor	Michael Baressi, Biological Sciences
Advisor Department	Biological Sciences
SURF Field of Study	Developmental Biology
Please list co-authors of your abstract	Emilie Jones, 2018

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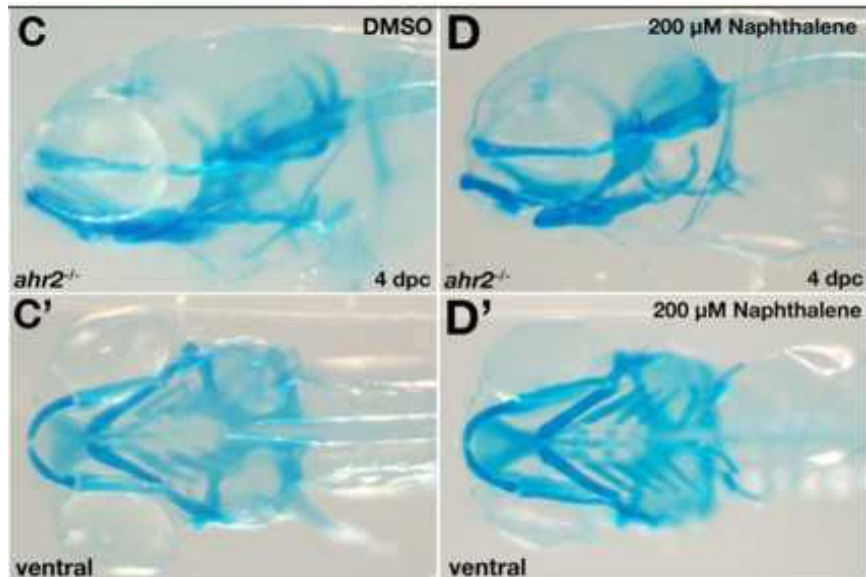
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Title of Abstract/Research Effects of polycyclic aromatic hydrocarbons (PAHs) on pharyngeal system development

Please type your abstract below.

Polycyclic aromatic hydrocarbons (PAHs) such as Naphthalene (naph), are hazardous compounds which could be found at high concentrations in fossil fuel pollutants and everyday consumables alike. To study how environmental teratogens such as PAHs can intersect and interfere with embryonic development, we have taken advantage of the extrauterine development of the utilized zebrafish model system. We aim to identify the cellular and molecular processes that mediate PAH teratogenesis of the craniofacial system. The craniofacial skeleton is derived in part from cranial neural crest cells (NCCs) which migrate through transient structures known as the pharyngeal pouches and arches. We postulated that naph could be targeting its effect on three possible cell types: the cranial NCCs, cells of the developing pharyngeal pouches, or epibranchial placodal cells that are known to interact with pouch and arch growth. Using antibody and transgenic reporters for both arches and pouches, we demonstrate that naph causes specific malformations in the posterior most region of the pharyngeal system. Our data supports a model in which PAH mediated teratogenesis first targets the posterior pharyngeal pouches that then indirectly impacts cranial neural crest cell migration. Placodal cells do not appear to be involved. This model is supported by changes in the early expression of the pouch marker hoxa2b among others. We are currently assessing the involvement of the Aryl hydrocarbon receptor pathway as mediating these teratogenic events.

SURF 2018-Post SURF Survey

Name	Abigail Edwards
Year of Graduation	2020

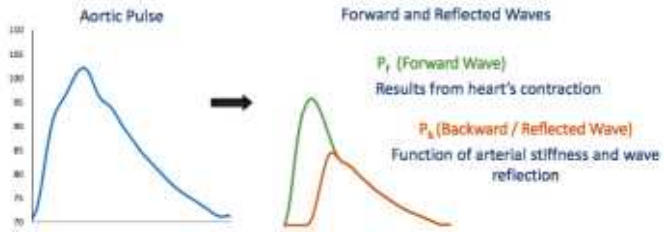|	
Are you in a Graduate program?	no
SURF Advisor	Non-Smith Advisor
If your SURF Advisor was not listed above you can enter their name here.	Sarah Witkowski
Advisor Department	Biological Sciences
SURF Field of Study	Exercise and Sports Studies

Upload image(s) in .png format; 1,100 MB max size each

AEdwards1.png

AEdwards2.png

$$PWV = \frac{\Delta L}{\Delta t}$$

Common carotid artery

Thoracic aorta

ΔL

Abdominal aorta

Femoral artery

Iliac artery

Δt

AEdwards3.png

Aortic Pulse

Forward and Reflected Waves

P$_f$ (Forward Wave)
Results from heart's contraction

P$_b$ (Backward / Reflected Wave)
Function of arterial stiffness and wave reflection
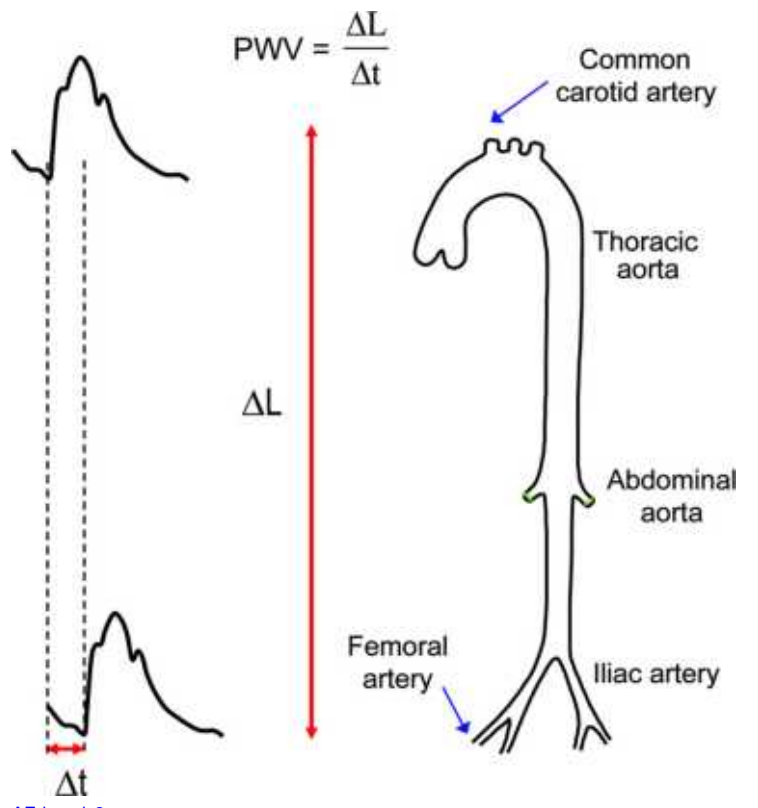
AEdwards4.png

Title of Abstract/Research   The effects of exercise on vascular function in a multiethnic population of women

| **Please type your abstract below.** | Cardiovascular diseases (CVDs) remain the leading cause of morbidity and mortality in women worldwide. Minority women are at greater risk for CVDs compared with Caucasian women. Risk for CVD may develop earlier in life in minority populations due to adverse health behaviors, socioeconomic factors, social environment, and access to care.

Central arterial stiffness is an independent predictor of CVD risk and mortality. It is assessed by carotid-femoral pulse wave velocity (cfPWV) and augmentation index (AIx). Pulse wave velocity measures the speed with which a pulse of blood travels down the aorta (Figure 1). Higher pulse wave velocity indicates a stiffer, less compliant vessel. Augmentation index (AIx) is a measure of the amplitude of the reflected arterial wave that amplifies the forward wave (Figure 2). Stiffer, less compliant vessels produce greater reflected waves. Some studies show differences in PWV and AIx by race/ethnicity and sex. However, there is a gap in knowledge about arterial stiffness at rest in young, black women.

One bout of aerobic exercise yields beneficial adaptations in arterial stiffness. The goal of this research is to evaluate differences in arterial stiffness at rest and after acute exercise in a multiethnic population of young, premenopausal women. I hypothesize that PWV and AIx at rest is greater in black women compared with Caucasian women. I further hypothesize that PWV and AIx is reduced after acute exercise in both black and Caucasian women.

Participants are healthy, non-smoking, premenopausal women ages 18-45. Cardiorespiratory fitness is measured via a maximal treadmill exercise test (VO2 max). PWV and AIx are measured at rest and 30 minutes after an acute bout of aerobic exercise (30 minutes at 60-64% of VO2 max). Vascular measures are completed on days 2-5 of the participant's menstrual cycle.

Data collection is ongoing. Evaluating differences in early, subclinical risk factors for CVD in females from different racial/ethnic backgrounds may promote early awareness and intervention and may aid in reducing health disparities.

Figure 1. (a) Measurements are made to estimate the length of the aorta between the carotid and femoral arteries. (b) PWV is calculated using ΔL, which is the length of the aorta between the carotid and femoral arteries, and Δt, which is the time it takes a pulse of blood to travel this length.

Figure 2. Depiction of the arterial waveform and the forward pulse wave augmented by the reflected pulse wave to assess AIx. |

SURF 2018-Post SURF Survey

Name	Kalani Williams
Year of Graduation	2018

Are you in a Graduate program?	no
SURF Advisor	Robert Dorit, Biological Sciences
Advisor Department	Biological Sciences
SURF Field of Study	Molecular Diagnostics
Upload image(s) in .png format; 1,100 MB max size each	KWilliams_Figure1.png
Title of Abstract/Research	A Novel Quantitative Real-Time PCR Diagnostic Assay for an Otariid Lungworm, Parafilaroides decorus
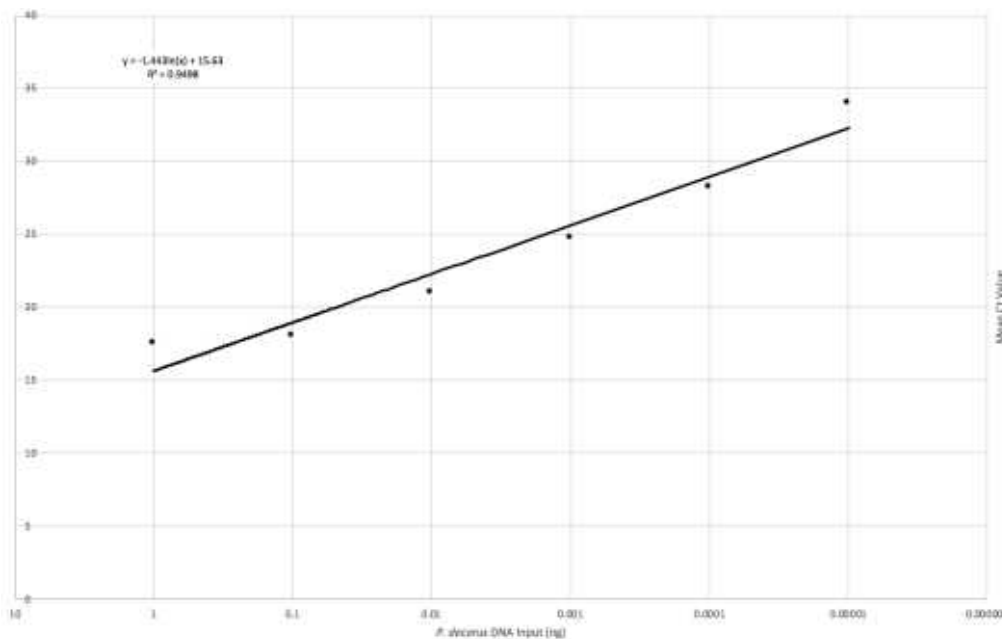
Please type your abstract below.

Parafialroides decorus is a metastrongylid nematode infecting otariids (eared seals) including the California sea lion (Zalophus californianus) and the Guadalupe fur seal (Arctocephalus townsendi) (1,2). Symptoms include anorexia, coughing, dyspnea, and blood in the stool and urine.1 Morphological identification of nematodes found in necropsied animals has historically been used to understand the parasitic burden in marine mammals. Unfortunately morphological identification is often not possible due either to the condition of the parasite or to the lack of specialists with sufficient expertise to make the identification. When we obtain new nematode samples, our standard procedure is to tentatively identify the species by sequencing three single barcoding genes: COX1, ITS2, and SSU. For definitive species identification, single gene barcodes are not sufficiently specific (3). Furthermore, to diagnose a live animal, regular PCR is often not sufficiently sensitive to pick up trace amounts of DNA from parasite eggs or larvae in the feces or sputum. By using a repeat-based quantitative PCR assay, we gain sensitivity. In nematodes these repeats evolve quickly enough that they are also species-specific (6).

We developed such an assay using an established pipeline, which included sequencing the full genome of P. decorus (5,6). We have now optimized this quantitative PCR assay using whole worm isolates and created a model for determining parasite burden from non-whole worm sample types (such as fecal samples) based on sensitivity testing (Figure 1). In testing the model on whole-worm isolate controls with known concentrations, the model estimated accurately to within 2 ng.

Part of the P. decorus life cycle involves releasing larvae from the otariid host into the water to find an intermediate host (a fish, Girella nigricans) (1). The larvae are released both in the sputum, coming from the respiratory tract, and in the feces after swallowing the larvae in the mucus (1). Fecal samples are routinely collected by marine mammal rehabilitation facilities, and therefore would be an ideal material to use to diagnose parasitic infections in living otariids. While P. decorus was identified from fecal samples in deceased otariids with known P. decorus infections, the assay also picked up P. decorus DNA from fecal samples of deceased otariids with no clinical P. decorus infections. This was only the case in otariids from areas where infections are prevalent; California sea lions from regions without the parasite and that have been in captivity long-term were not found to have any P. decorus DNA. The otariid host acquires the parasite from eating the intermediate fish host, Girella nigricans (1). We hypothesize that the DNA detected in the clinically uninfected otariids was obtained from eating fish infected with the parasite and that the otariid did not contract the parasite because either the infection level in the fish was too low, or the parasite was at the incorrect life-stage to survive in the otariid host. The assay can detect P. decorus DNA in concentrations as low as 50 femtograms per microliter, so it is conceivable that such a minor event could be detected.

Parasite eggs and larvae that were ingested via food but not clinically contracted still appear in fecal samples, so from testing a fecal sample alone it is impossible to know if an otariid is infected. In the future we plan to test this assay on sputum samples, which should only have parasite larvae from clinically relevant infections and not from infected material in the diet. We have recommended to our collaborating marine mammal rehabilitation facilities that they begin collected sputum samples from animals that could have lungworm infections for quantitatively accurate diagnoses in the future.

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3. Moritz, C., and Cicero, C. (2004). DNA Barcoding: Promise and Pitfalls. PLoS Biol. 2, e354.
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Name	Jane Milcetic **Smith**
Year of Graduation	2020

Are you in a Graduate program?	no
SURF Advisor	Christine White-Ziegler, Biological Sciences
Advisor Department	Biological Sciences
SURF Field of Study	Microbiology
Title of Abstract/Research	Expanding the RpoS Regulon in Uropathogenic and Nonpathogenic Escherichia coli
Please type your abstract below.	

Uropathogenic Escherichia coli (UPEC) are virulent bacteria that cause 75-95% of urinary tract infections (UTI), which can lead to cystitis, pyelonephritis, and bacteremia (reviewed in Subashchandrabose & Mobley 2015). Women are disproportionately affected by UTIs, as 40% of women will have a UTI during their life, and 20-30% of women have a second UTI within 3-4 months (reviewed in Subashchandrabose & Mobley 2015; Terlizzi, Gribaudo & Maffei 2017).

As with other strains of E. coli, UPEC can survive the turbulent environment inside and outside of hosts by responding to changing stresses. RpoS, a stress-responsive sigma factor that controls transcription of at least 1,044 genes (23% of E. coli's genome), allows E. coli to navigate shifting acidity, osmolarity, and temperatures along with other deleterious environmental changes (Wong et al. 2017). With the many regulatory layers that control RpoS production, E. coli can adapt to and survive the external world and the hostile human body. Researching RpoS is important for maintaining antimicrobial spaces in hospitals, as patients may develop E. coli infections because bacteria remain in supposedly sterile zones.

While past research has identified genes within the RpoS regulon by studying E. coli under osmotic stress, acidic stress, and in stationary growth, none have surveyed the genes controlled by RpoS upon a temperature shift from room temperature (23ºC) to human body temperature (37ºC) (Wong et al. 2017; Weber 2005). Research from the White-Ziegler lab indicates that 122 known genes within the RpoS regulon are thermoregulated in the commensal strain while unpublished studies for the UPEC demonstrate that 83 RpoS-dependent genes are expressed at 37ºC (2008). Thus, our studies indicate that RpoS is a central player in adaptation to changing temperature.

The goal of this study is to understand how temperature affects RpoS regulation of genes in nonpathogenic E. coli as compared to UPEC. To examine this, wild

type and ΔrpoS mutant strains of K-12 and UPEC were grown at 23˚C and 37˚C for 8-10 generations in M9 minimal media containing glycerol as a carbon source. RNA was harvested from the cells, treated with DNase to removed residual DNA, and purified. Future steps in the project will include preliminary testing with qRT-PCR to confirm temperature regulation of a subset of candidate genes and removal of ribosomal RNA. Library synthesis will then be completed for RNA-Seq to determine the whole transcriptome under our varying conditions. Analyses of the wild type and ΔrpoS dataset will allow us to determine which genes are regulated by RpoS under the two temperatures. Contrasting of K-12 and UPEC will highlight the different roles RpoS plays in different E. coli strains, and expand the sigma factor's regulon.

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SURF 2018-Post SURF Survey

Name	Vivienne Maxwell
Year of Graduation	2021

Are you in a Graduate program?	no
SURF Advisor	Sara Pruss, Geosciences
Advisor Department	Geosciences
SURF Field of Study	Paleontology

Fig1-VMaxwell.png

Fig2-VMaxwell.png

Title of Abstract/Research   Recovery of Bioturbation in Early Triassic Samples

Please type your abstract below.

The end-Permian mass extinction was the greatest extinction of all time. It is estimated that around 90% of marine species went extinct (Shen, Bowring., 2014). The recovery period during the Triassic was a long one, perhaps a reflection of the devastation of this event. The late-Early Triassic period is an interesting time to study, as it is ~5 million years after the mass extinction, and therefore reflects some level of recovery, but not total recovery, that was delayed until Middle Triassic time (A. Hallam., 2009). Essentially, the main goal of this research was to examine the nature and distribution of bioturbation and the fossils in insoluble residues of limestones collected from the upper Lower Triassic Virgin Limestone Member of the Moenkopi Formation.

The research was conducted in two parts: (1) dissolving, picking and imaging microfossils and (2) studying trace fossils (bioturbation). A group of researchers went to the Lost Cabin Springs (LCS) locality in Nevada and collected several samples of fossiliferous packstone from the Virgin Limestone Member. These samples were then dissolved in acid and the residue was sieved using No. 40, No. 60 and No. 80 mesh sieves. Microfossils were picked and imaged on the Scanning Electron Microscope. EDAX element analysis was done in order to determine which minerals had replaced the fossils, all of which were originally calcium carbonate. EDAX results show that the fossils were replaced by apatite and iron oxides. These samples were different than those previously examined from the Lost Cabin Springs locality (Pruss et al., in review), in that in addition to snails and echinoderms, abundant brachiopods were found, as well as a currently unknown fossil which may be brittle star fragments (Figures 1, 2). Thin sections were made of the rocks from the same locations within the Lost Cabin Springs locality. The goal is to image specific parts of the thin section to better understand how organisms interacted with the sediment during an overall period of suppressed bioturbation (Pruss et al., 2004). Future research includes better constraining the environments that were present in the Virgin Limestone during this recovery interval and preparing this work for publication.

Fig. 1: Internal mold of a high-spired gastropod from sample LC-18-18-A

Fig. 2: Unknown and new fossil discovery, sent to experts for review, from sample LC-18-34

SURF 2018-Post SURF Survey

Name	Andrea Olivera
Year of Graduation	2019

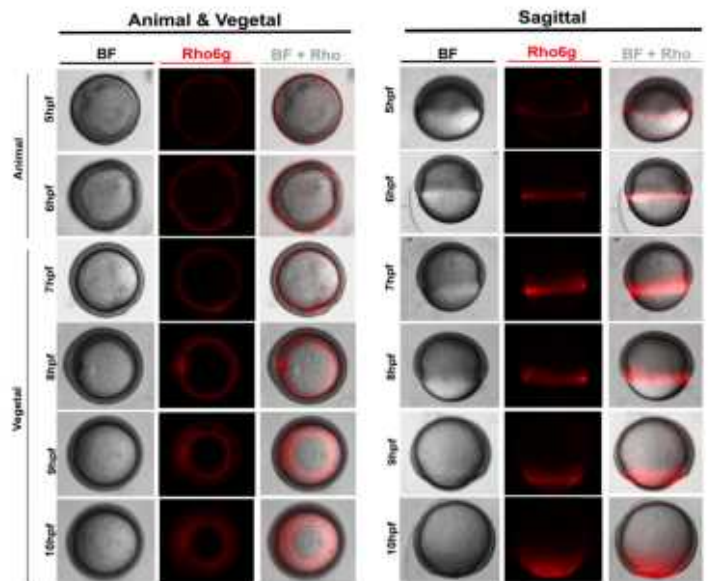|	
Are you in a Graduate program?	no
SURF Advisor	Michael Baressi, Biological Sciences
Advisor Department	Biological Sciences
SURF Field of Study	Developmental Biology- Bioelectrics

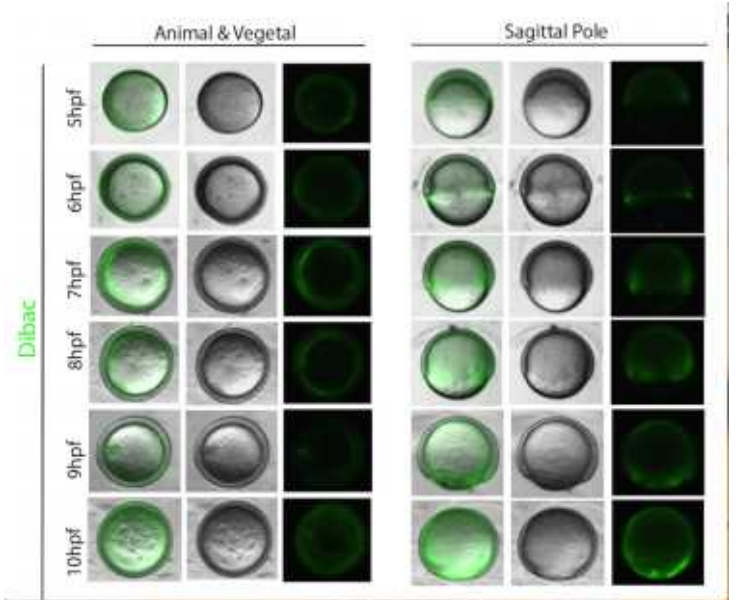**Upload image(s) in .png format; 1,100 MB max size each**
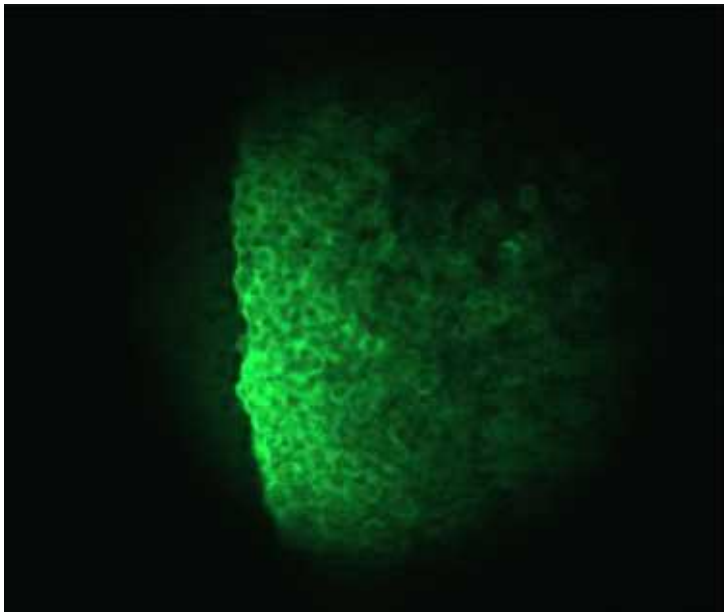
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Title of Abstract/Research	Determining the role bioelectric signaling plays on Danio rerio development
Please type your abstract below.	Continuous signal exchange among cells, tissues, and organs in a developing embryo are required for embryonic patterning and cell fate determination. A cells membrane voltage potential (Vmem) is derived from the exchange of ions across a cells membrane. These voltage gradients run alongside biochemical gradients and transcription regulatory systems to guide cell behavior of an individual cell and it's neighboring cells to derive anatomical pattern formation signals. Recent studies have introduced the development of molecular techniques to trace ion flow and manipulate ion channels and pumps to suggest that voltage gradients play a role in the regulation of cell behavior and formation of complex structures. With the use of fluorescent bioelectric reporters and genetically encoded indicators we were able to visualize the patterns of Danio rerio throughout embryonic development. We see the most activity during 5 hours post fertilization(hpf) to 10 hpf in the gastrula. This data can allow tracking the effects that submerge from functionally manipulating the activity of ion channels and pumps in Danio rerio. Visualizing and manipulating the information stored in physiological networks can result in game-changing implications for developmental biology, and even regenerative medicine. The manipulation of these functions could reveal the relationship between ionic properties of cellular structure and the anatomical morphology, as well as the possible mechanisms that voltage gradients play a role in to orchestrate cell behavior.

SURF 2018-Post SURF Survey

Name	Rebecca Miller
Year of Graduation	2020
Are you in a Graduate program?	no
SURF Advisor	Andrew Berke, Chemistry
Advisor Department	Chemistry
SURF Field of Study	Aerosol Chemistry
Please list co-authors of your abstract	Hannah Inman/2020
Upload image(s) in .png format; 1,100 MB max size each	R. Miller surf image.png
Title of Abstract/Research	The Effect of Temperature and Atmospheric Alcohol Concentration on the Thermodynamics of Aerosol Mimicking Solutions

R. Miller surf image.png

Please type your abstract below.

Organic aerosols (OA) and secondary organic aerosols (SOA) are an interesting and inevitable component of Earth's atmosphere and ecosystems resulting from the partitioning of volatile organic materials. SOAs are formed when a primary pollutant, also know as an OA, reacts with hydroxide, sulfates, nitrates, and/or free radicals in the atmosphere. The product of such reactions is, henceforth, referred to as SOA because it is a secondary environmental pollutant that is formed from a primary pollutant. Aerosols are microscopic particles suspended in the atmosphere that provide a surface for the condensation of water as well as the absorption and scattering of light. The formation of OA and SOA is a topic worth studying because these pollutants can be harmful; therefore, they have an enormous influence on human life and air quality (Yi et al.). Little research has been done to understand the effects of specific alcohols on the reactions of glyoxal with nitrogen-containing compounds. Alcohols are available to these aerosols in the atmosphere, so it is important to observe how different concentrations of alcohols and temperatures affect these reactions.

This research focuses on the effect of alcoholic solvent systems (methanol, ethyl alcohol, tert-butanol, 3-methyl-2-butanol, etc.) on the reaction between ammonium sulfate and glyoxal at changing alcohol concentration and temperature. The main purpose of our research was to observe the temperature dependence of the reactions between 3.0 M ammonium sulfate, 0.095 M glyoxal, and 0.00M-1.00 M of an alcohol. Reactions were performed by mimicking the aerosols in bulk, aqueous solution which included ultrapure water, ammonium sulfate, glyoxal, and one of the alcohols. Long-term light spectroscopy readings were taken on a Thermo UV-Visible Spectrophotometer over periods of time ranging from approximately 24-72 hours and at different temperatures in order to map the change in light absorbance over time. Thus far we have determined that reactivity within the system increases as both concentration and temperature increase.

Experiments to determine the terminal point of the reaction being studied were also conducted alongside that of the tests discussed previously. To determine the terminal point of the glyoxal and ammonium sulfate reactions in alcoholic solvent systems, the reaction was monitored over a period of roughly ten days via UV-visible spectroscopy. The data collected in these long term experiments could be further extrapolated to help fill in the gaps left by the short term measurements.

Additionally, solutions were made with another group of alcohols; 1,3-propanediol, 1,2-propanediol, 1,4-butanediol, acetone, and acetonitrile. These alcohols are also prevalent in the atmosphere, and the aqueous solutions were prepared in a similar way to that of the thermodynamics solutions. The viscosity, pH, and light absorbance over time were measured for these solutions. Further research needs to be conducted to better understand the results of the pH and viscosity experiments. The data collected in these experiments could potentially be used to understand the kinetics of SOA formation under similar conditions in a non-controlled environment.

References:

Yi, Y., Cao, Z., Zhou, X., Xue, L., & Wang, W. (2018). Formation of aqueous-phase secondary organic aerosols from glycolaldehyde and ammonium sulfate/amines: A kinetic and mechanistic study. Atmospheric Environment, 181, 117-125.

Name	Juliette Saux **Smith**
Year of Graduation	2020

Are you in a Graduate program?	no
SURF Advisor	John Loveless, Geosciences
Advisor Department	Geosciences
SURF Field of Study	Structural Geology
Title of Abstract/Research	Effect of slow slip on uplift across the Olympic Peninsula and implications for the downdip extent of locking on the Cascadia Subduction Zone.

Please type your abstract below.

The Cascadia Subduction Zone, extending from Northern California to Vancouver Island, has not experienced a major earthquake since 1700 and presents a seismic risk for the Pacific Northwest. Slow slip events (SSE), which have been detected on the subduction interface, are characterized by aseismic slip and occur over several weeks to months, rather than the seconds to minutes duration of an ordinary earthquake. Slow slip events are thought to occur downdip of the interseismically locked zone on the subduction interface, calling into the question the source of the stresses causing this slip. We want to understand what causes the stress that is released by SSEs, the long-term effect of deep, aseismic slip on fore-arc deformation patterns, and the spatial disparity between the zone of locking and the zone of slow slip.

We use GPS observations from the Plate Boundary Observatory to estimate the spatial distribution of coupling and slow slip. We calculate interseismic velocities as a ~20-year average after removing displacements from each slow slip event, so they only reflect motion between SSEs. Including SSE displacements in the velocity field calculation would underestimate the truly interseismic velocities that reflect the strain accumulation process.

Models confining subduction zone coupling to the shallowest 30 km of the plate interface predict vertical displacements consistent with long-term net uplift of the Olympic Peninsula, but do not predict downdip slip deficit that could explain the recurrence of SSEs. Models permitting coupling deeper than 30 km estimate slip deficit on the deep extent of the interface, providing a source of stress that may be released by SSEs. These models also predict interseismic subsidence across the Olympic Peninsula, which is inconsistent with observed coastal uplift and past records of coseismic subsidence. Adding the vertical displacement signatures of slow slip events to these models, however, yields deformation more consistent with long-term coastal uplift (figure 1), effectively shifting the boundary between uplift and subsidence westward. These results could indicate that the zone of coupling extends farther downdip than originally thought and is separated into a seismogenic zone and a zone characterized by the periodic occurrence of slow slip events.

SURF 2018-Post SURF Survey

Name	Ruby Wu
Year of Graduation	2020
Are you in a Graduate program?	no
SURF Advisor	Elizabeth Jamieson, Chemistry and Biochemistry
Advisor Department	Chemistry
SURF Field of Study	Chemistry
Please list co-authors of your abstract	Alisha Shrestha '19, Ruby Wu '20, Chhiring Lama '21
Upload image(s) in .png format; 1,100 MB max size each	\nsurf2018rwu.PNG
Title of Abstract/Research	Spiroiminodihydantoin Lesion Synthesis and Analysis of Thermodynamic Stability of Mismatched DNA Using UV/Vis Spectroscopy
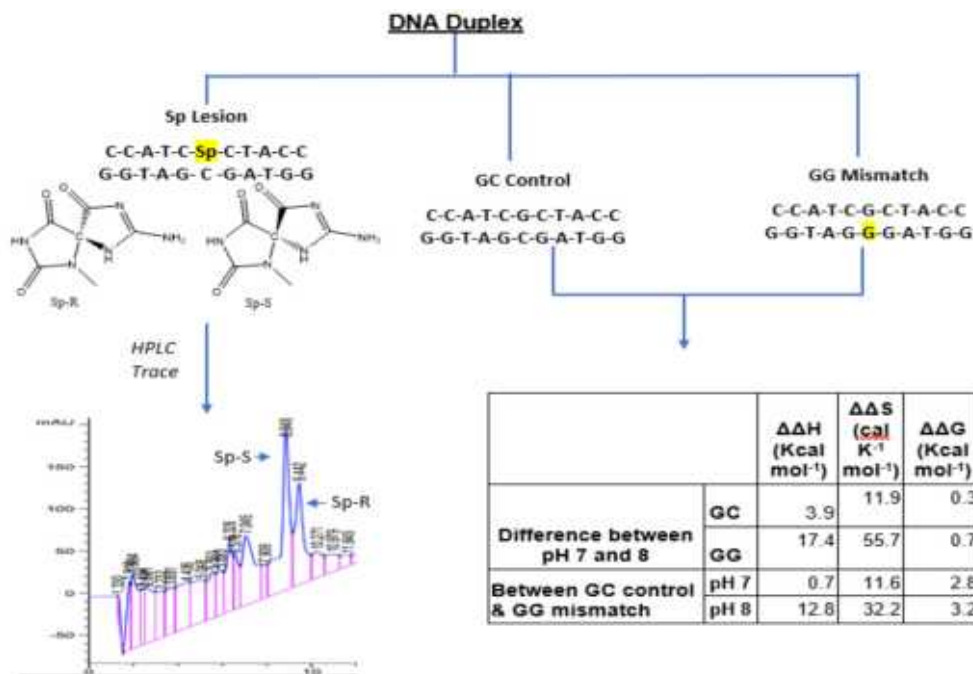
Please type your abstract below.

DNA contains the genetic information needed to sustain life. When DNA is damaged, cancer and neurodegenerative diseases can result. This summer, we investigated two different types of DNA damage. The first type, the spiroiminodihydantoin (Sp) lesion, forms when a guanine nucleobase is oxidized. The second type of damage investigated was the effect of having a DNA mismatch (a non-Watson-Crick base pairing partner) on the DNA duplex. The thermodynamic stability (ΔH, ΔS and ΔG) of mismatched versus normal DNA was calculated using data acquired through melting temperature (Tm) experiments on a UV-Vis spectrophotometer. The major findings from these experiments are shown in Figure 1 and will allow us to better understand how mismatches affect the stability of DNA duplexes.

In preparation for 2-D NMR Nuclear Overhauser Effect Spectroscopy (NOESY) studies comparing control and damaged DNA, an 11-mer DNA strand containing 8-oxo-guanine was oxidized using sodium persulfate and sodium bicarbonate. The two diastereomeric lesions, Sp1 and Sp2, were identified using mass spectrometry, collected, and purified using HPLC, giving a yield of 46%. The material collected will be used for future NMR experiments on Sp lesion containing DNA duplexes.

SURF 2018-Post SURF Survey

Name	Rhiannon Nolan
Year of Graduation	2019

Are you in a Graduate program?	no
SURF Advisor	Sara Pruss, Geosciences
Advisor Department	Geosciences
SURF Field of Study	Paleontology

Upload image(s) in .png format; 1,100 MB max size each

Stratigraphic Column of the Harkless and Mule Springs Formations at Palmetto Mountain, Nevada
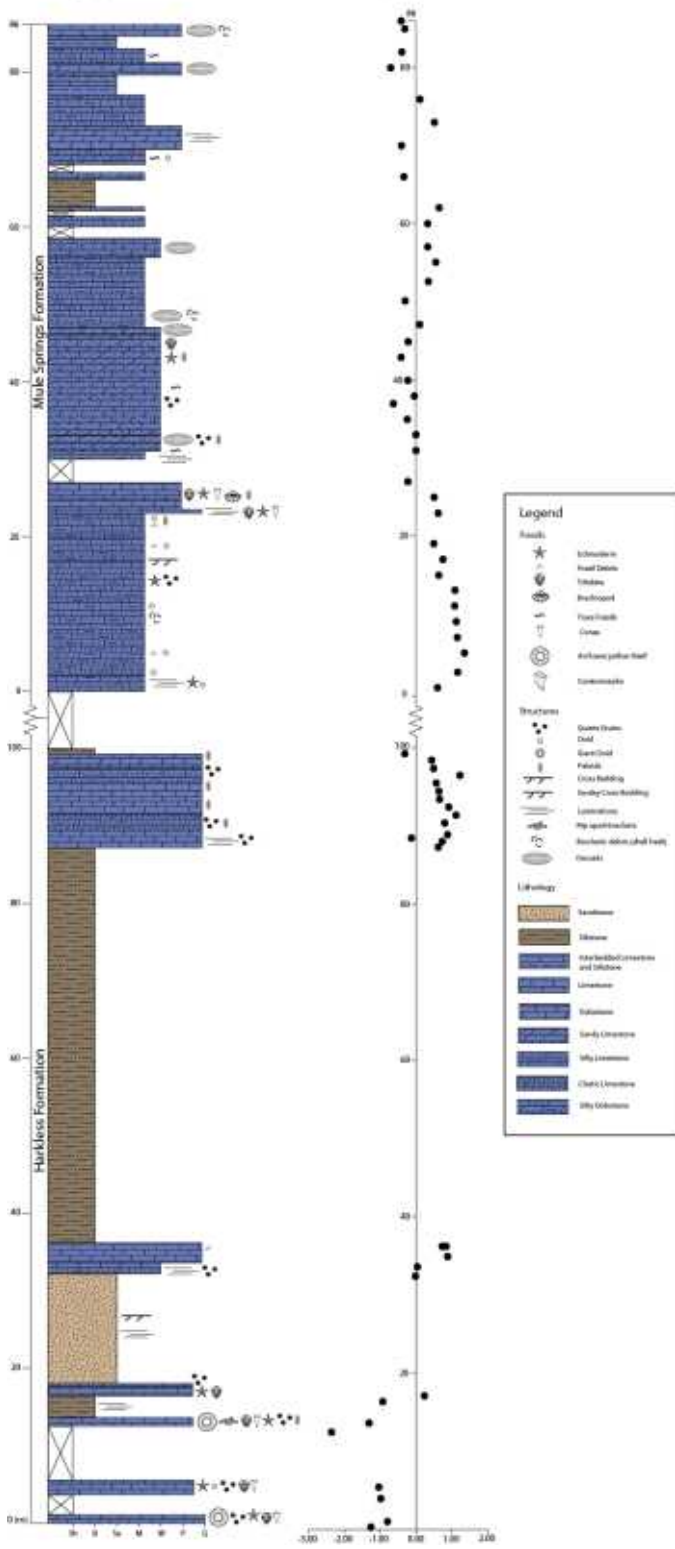
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| Title of Abstract/Research | When and How Did the Demise of the First Animal Reefs Occur? |

Please type your abstract below.

In the early Cambrian Period, the archaeocyaths, an early calcifying sponge, became the dominant organisms to produce the first biotic reefs with skeletally secreted frameworks (e.g., Rowland and Shapiro, 2002). Reefs have been shown to be a major driver of evolutionary diversity and abundance during the early Cambrian interval but these archaeocyathan reefs were short-lived, becoming extinct before the close of the early Cambrian (Zhuravlev and Wood, 1996). In strata of the western United States, archaeocyathan reefs are well known through the lower Cambrian Poleta and Harkless formations, with their disappearance constrained to sometime after the Harkless reefs (Knoll and Fischer, 2011). Although this disappearance of archaeocyaths has been documented globally, the impacts of this extinction on other non-reef benthic organisms are less well known. Samples from reef-adjacent environments in the Harkless and Mule Springs formations that pre- and post-date the extinction of archaeocyathan reefs were collected at Palmetto Mountain, Jackson Mountain, and near Gold Point, Nevada. These samples were point counted using the grain solid method to glean insights into the nature of skeletal carbonate production outside of reef settings before and after the demise of the earliest animal reefs. Prior to the extinction, samples range from 0-25% (average 12.4%) skeletal material, which changes rapidly in the uppermost Harkless and lower Mule Springs (ranges from 0-13% skeletal material, average 1.8%). The fossiliferous grainstone facies in the pre-extinction Harkless, which contain trilobites, echinoderms, brachiopods and Salterella, are replaced by oolitic and oncoidal non-skeletal facies in the post-extinction interval, and skeletal diversity becomes dominated by trilobites and echinoderms only. As a whole, it appears that in addition to the decline of skeletal organisms that inhabited reef settings, organisms in other benthic ecosystems also show a loss of diversity and abundance across the early Cambrian extinction in the western United States.

References:

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Rowland, S.M., and Shapiro, R.S. (2002). Reef patterns and environmental influences in the Cambrian and earliest Ordovician, in Kiessling, W., Flügel, E., and Golonka, J., eds., Phanerozoic Reef Patterns: SEPM Special Publication, v. 72, p. 95–128

Zhuravlev, A. Y., & Wood, R. A. (1996). Anoxia as the cause of the mid-Early Cambrian (Botomian)
extinction event. Geology, 24(4), 311-314.

SURF 2018-Post SURF Survey

Name	Meng Cao
Year of Graduation	2019

Are you in a Graduate program?	no
SURF Advisor	Kristen Dorsey, Engineering
Advisor Department	Engineering
SURF Field of Study	Engineering
Title of Abstract/Research	Characterization of Soft Robotic Fingers

Please type your abstract below.

A bellow-shaped finger, when inflated with air, curls like a human finger. [1] Several fingers and a spherical "palm" are assembled to achieve grasping fragile objects. This finger is designed specifically for biological sampling on deep sea organisms. Integration of curvature sensors on the finger is necessary to enable sensing the actuator's position and shape during teleoperation. This work characterized a PneuNet with a similar bellow-shaped design but made with a different kind of elastomer (Eco-flex 00-30), which is a rubbery silicone material. The relationship between the piecewise constant curvatures of the PneuNet and the volume of air inject into its chambers though a syringe and tubing was found. The relationship points out which segments of the PneuNet experience greater changes of curvature during the actuation process, and therefore are the optimal positions for curvature sensor implementation.

The PneuNet was marked with a series of red dots with 1 cm spacing along the bottom. The camera was positioned to view the PneuNet actuator from the side. 26 mL of air was pressured into the actuator gradually, and for each milliliter of air, the camera took a picture. All the pictures were then corrected in Photoshop for lens distortion and analyzed using MATLAB. The red dots in each image were recognized using the image processing toolbox and error was eliminated. The order of dots was correctly labeled by manually clicking on the dots, from the most proximal to the most distal. This process was repeated for each image before the weighted centroids were found and piecewise constant curvatures are determined by each three adjacent centroids. Two different actuating positions of the PneuNet were investigated in this work, sitting on table and suspended in air, to determine how gravity and orientation affect the performance of the PneuNet.

Data shows that the PneuNet has very different curling profile in the two positions. The difference can be explained by the gravitational force acting on the PneuNet. For the PneuNet sitting on table, P7 is the optimal place to implement the sensor because the piecewise constant curvatures at that point are evenly distributed and mostly monotonically increasing throughout actuation. For PneuNets suspended in air, both P6 and P7 are ideal places.

[1] K. Galloway et al., "Soft Robotic Grippers for Biological Sampling on Deep Reefs," Soft Robot., vol. 3, Jan. 2016.

Name	Emily Morris
Year of Graduation	2019
SURF Advisor	Stylianos Scordillis, Biochemistry
Advisor Department	Biochemistry
SURF Field of Study	Biochemistry

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Table 1: Sample concentrations as determined by Lowry Assay for each condition and time point. Average concentrations for each sample condition are shown below with their standard error.

Condition	Developmental Stage	[Replicate 1] (µg/µL)	[Replicate 2] (µg/µL)	[Replicate 3] (µg/µL)	[Average] ± Std Error (µg/µL)
Control Medium	Myoblast (Day 0)	2.13	4.02	4.26	3.5 ± 0.7
	Early Myotube (Day 5)	4.38	5.09	5.19	5.0 ± 0.3
	Late Myotube (Day 9)	5.45	9.50	6.82	7.3 ± 1.2
Vehicle Control Medium (DMSO)	Myoblast (Day 0)	1.80	3.16	4.90	3.3 ± 0.9
	Early Myotube (Day 5)	9.44	10.20	7.59	9.1 ± 0.8
	Late Myotube (Day 9)	10.15	8.18	6.32	8.2 ± 1.1
Nandrolone Decanoate Medium	Myoblast (Day 0)	2.42	3.04	2.90	2.8 ± 0.2
	Early Myotube (Day 5)	8.81	7.61	9.07	8.5 ± 0.5
	Late Myotube (Day 9)	2.21	4.55	8.14	5.0 ± 1.7

SURF Abstract Figure.PNG

Title of Abstract/Research	Myogenic Protein Changes in Response to Anabolic Steroids in Murine Skeletal Muscle Cells

Please type your abstract below.

Anabolic steroids have been the subject of the performance enhancement controversy for the past sixty years, but their effects on skeletal muscle at the molecular level are not well characterized. This is in part because most steroid research is at the organ physiology level instead of the molecular level, despite the fact that the mechanism(s) of action is based entirely in cellular biochemistry. These classical mechanisms of steroid action alter gene expression leading to changes in protein expression. Proteins are responsible for nearly all cellular work. If genetics can be analogous to blueprints for a cell, proteins are the interpreters, editors, regulators, and building-blocks. Thus, understanding the anabolic steroid mechanism(s) is directly tied to the expression of specific proteins and protein networks in skeletal muscle. By studying myogenesis, the developmental progression of myoblasts to contractile myotubes in vitro, with comparative proteomics, the pathways of anabolic steroid function can be elucidated. This SURF project sought to initiate exploration of the proteome changes in murine C2C12 cells at the three stages of myogenesis (myoblasts, early and late myotubes) in the presence and absence of an anabolic steroid, nandrolone decanoate, with the intention to continue the research and analysis in an honors thesis during the 2018-2019 academic year.

Mouse skeletal muscle cells were grown in one of three environmental conditions: controls in a standard cell culture medium and experimental cells were either grown in physiological levels of nandrolone decanoate in DMSO - one of the most common performance enhancing steroids - or in an equal concentration of the steroid vehicle, DMSO, alone. Cells were then harvested at three different stages (n=3): myoblasts, early myotubes, and late myotubes. Once harvested, the samples were extracted and cell lysate homogenates were analyzed by the Lowry Assay for total protein. The samples were then subjected to tryptic digestion and frozen for later analysis by high pressure liquid-chromatographY-coupled mass spectrometry (LC/MS). Protocols were developed for Smith's new high-resolution mass-spectrometer using skeletal muscle samples.

Cell growth in all conditions was successful: mononucleate myoblasts proliferated well; they exited the cell cycle and formed multinuclear early myotubes; and further developed into large late myotubes. As my honors thesis proceeds in the coming academic year, I will continue this work by labeling the samples with isobaric mass tagging reagents (TMT-labeling) to be massed and quantitatively assessed by LC/MS analysis. These analyses will yield both protein identifications and quantification. One parsed, these data should establish the effects of nandrolone decanoate on the C2C12 proteome during myogenesis and may yield insight into the interacting pathways of cellular steroid regulation.

SURF 2018-Post SURF Survey

Name	Molly Day
Year of Graduation	2019

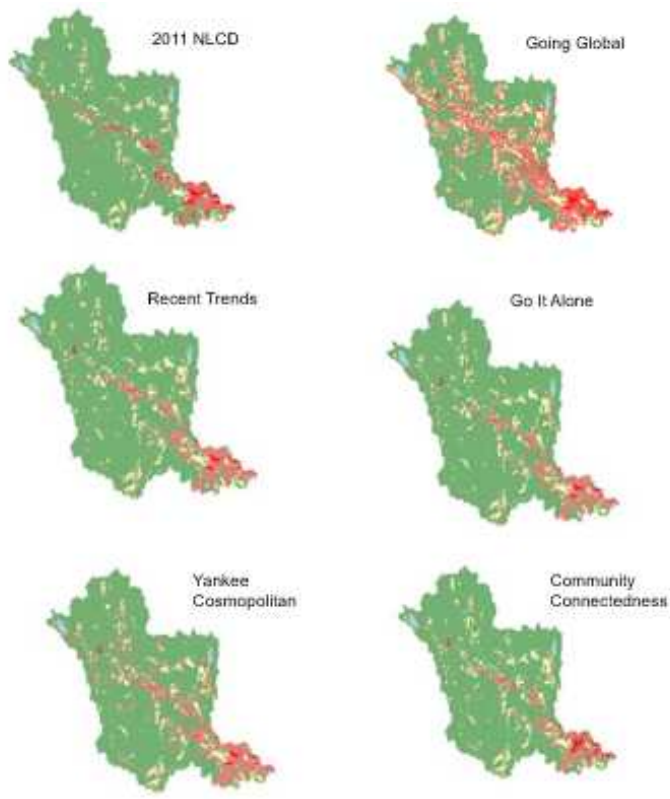|	
Are you in a Graduate program?	no
SURF Advisor	Andrew Guswa, Engineering
Advisor Department	Engineering
SURF Field of Study	Environmental Engineering
Upload image(s) in .png format; 1,100 MB max size each	

SURFfiguremday.PNG

2011 NLCD

Going Global

Recent Trends

Go It Alone

Yankee Cosmopolitan

Community Connectedness

Legend	
🟥	High Density Development
🟧	Low Density Development
🟩	Forest
🟨	Agriculture
🟫	Other
🟦	Open Water
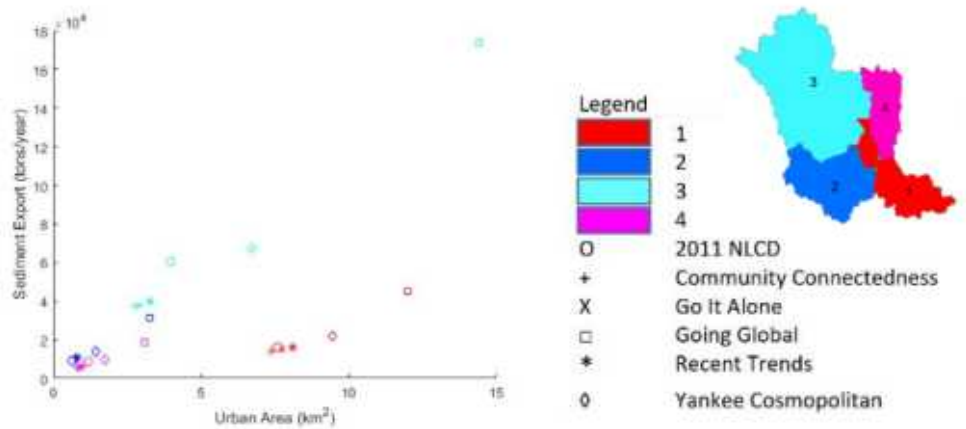
Land Cover Percentages

	2011	GIA	GG	YC	RT	CC
urban	10%	9%	24%	14%	10%	9%
forest	83%	82%	63%	77%	81%	82%
agriculture	5%	6%	9%	6%	6%	6%
other	1%	3%	3%	3%	3%	3%
water	1%	1%	1%	1%	1%	1%

landusescenariosmday.PNG
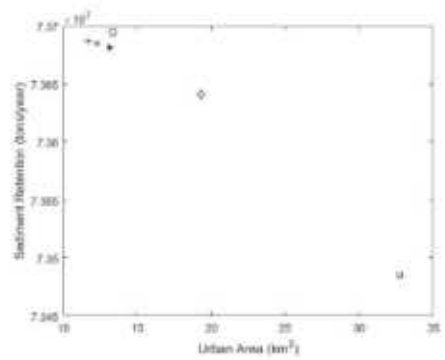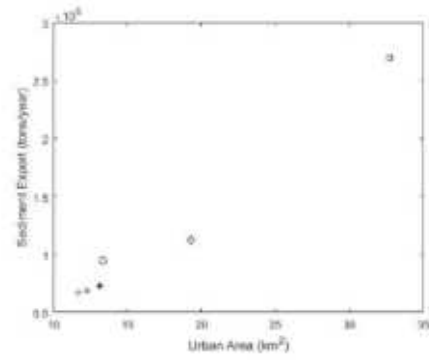
retentionandexportmday.PNG

Title of Abstract/Research	Land-Use Effects on Sediment Yield in the Mill River Watershed

Please type your abstract below.

Excessive sedimentation can degrade the ecological health of rivers and increase water management costs. These issues are exemplified by Paradise Pond in the Mill River watershed in western Massachusetts; costly dredging is required to remove excess sediment and maintain an open pond. This study focuses on how potential changes in land use/land cover (LULC) will affect sediment retention and sediment export within the Mill River watershed. Using the Sediment Delivery Ratio model from the InVEST suite of tools, LULC raster data from 2011 and five LULC scenarios for 2060 devised by Harvard Forest in conjunction with stakeholders were used to model sediment export and retention in four sub-watersheds. Three of the future scenarios have a similar fraction of the landscape that is developed versus forested, and they show similar values of sediment export and retention. The other two have a greater fraction of urban area and show less sediment retention and more export. Linear regression suggests that sediment export is a strong function of urban area. The regression coefficient varies across sub-watersheds, with the northern sub-watershed showing a greater increase in sediment export per square kilometer increase of developed area compared to other sub-watersheds. The results also indicate that using best management practices and low-impact development may significantly reduce export. Conversion from forested to developed areas can significantly impact sediment export, and the severity of this impact is related to how and where the conversion takes place.

Fig 1. Land-use scenarios investigated.
Fig 2. Total sediment retention and total sediment export. Community Connectedness, Go It Alone, and Recent Trends all have similar sediment export and retention, as well as similar land cover. They have slightly lower sediment retention and lower sediment export than the 2011 baseline. Yankee Cosmopolitan and Going Global have a much larger impacts on export and retention.
Fig 3. Sediment export per sub-watershed plotted against urban area per sub-watershed per scenario. There is a strong linear relationship between urban area and sediment export within sub-watersheds.

SURF 2018-Post SURF Survey

Name	Sasha Clapp **Smith**
Year of Graduation	2019

Are you in a Graduate program?	no
SURF Advisor	Marney Pratt, Biological Sciences
Advisor Department	Biological Sciences
SURF Field of Study	Biology/ Ecology
Please list co-authors of your abstract	Lyric Williams, Renee Halloran
Upload image(s) in .png format; 1,100 MB max size each	 SURF Summer 2018 Abstract Figure.png
Title of Abstract/Research	The Fourth Year of the Paradise Pond Project: Macroinvertebrates as Bioindicators of River Health
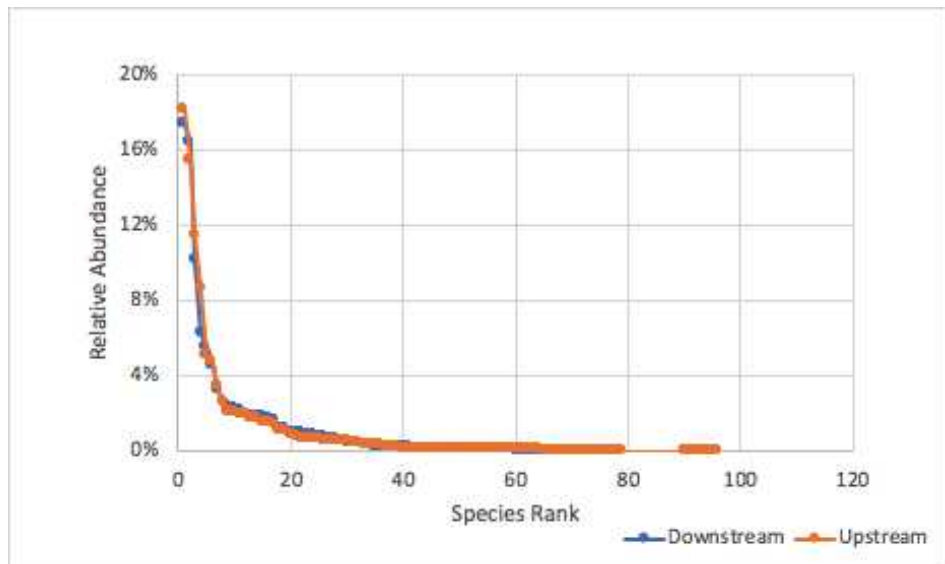
Please type your abstract below.

Paradise Pond, a treasured landmark and a valued recreational and educational resource of the Smith College Community, is an impoundment created by a dam on the Mill River (Sinton 2002). Because dams fundamentally disrupt the movement of water, and therefore movement of sediment, Smith College has implemented a sediment management protocol to prevent Paradise Pond from completely filling with the inevitably accumulating deposition (Wells et al. 2007). Although managing sediment is innately disruptive to the surrounding environment, it is necessary to maintain the existence of the pond. In an attempt to minimize the ecological consequences of sediment redistribution in the pond, state regulations require Smith College to monitor the ecological impact that sediment management has on the Mill River and to assess the best method of managing the sediment long-term. The Paradise Pond Sediment Management Project can therefore best be described as a continual assessment of the balance between preserving the iconic Paradise Pond and ensuring the ecological health of the Mill River while doing so.

To assess Smith College's impact on the Mill River, the Before-After-Control-Impact (BACI) design was utilized to compare diversity indices of macroinvertebrates upriver (control) and downriver (impact) of Paradise Pond before and after the July 2016 sediment redistribution (Strayer & Smith 2003). The relative ease with which freshwater invertebrates can be surveyed make them ideal systems to assess how Smith College's sediment management in Paradise Pond might influence the river. Aquatic macroinvertebrates function as an indication of stream health because many are intolerant of environmental variability. Comparisons of macroinvertebrate communities in upriver and downriver sites can illuminate whether or not sediment redistribution in July 2016 has had any impacts on the river 2 years later. Using kicknet sampling, macroinvertebrates were collected during June 2018 at upriver and downriver riffle sites, and then identified to the lowest level feasible (usually the genus level).

A healthier river is typically more diverse. One of the ways to assess river diversity is to compare species rank abundance curves from both sites using a pairwise Kolmogorov-Smirnov test. Organisms were ranked from most to least abundant and relative abundances were calculated. In June 2016, before sediment redistribution, the downriver site was significantly more diverse than the upriver site (d-stat = 0.1112, d-crit= 0.0735, p=0.0004). One year after sediment redistribution, in summer 2017, the upriver site was significantly more diverse than the downriver site (d-stat= 0.0968, d-crit= 0.0737, p=0.003), suggesting that sediment redistribution had an impact on the downriver site. However, in summer 2018, there was no significant difference in diversity between the two locations, (Figure 1: d-stat = 0.0359, d-crit = 0.0476, p=0.24). These results suggest that two years after sediment redistribution in Paradise Pond, macroinvertebrate communities are recovering from the impact of redistribution.

Figure 1. Species Rank Abundance Curve for the macroinvertebrate data collected in June 2018 from the Mill River in Northampton, MA. Species rank was determined by ranking organisms from most to least abundant where a rank of 1 represents the most abundant. Most organisms were identified to the genus level, but for this analysis all worms were lumped together at the class level, and all midges were lumped together at the family level. Relative abundance was calculated as the number of a particular organism divided by all organisms found at the same location times 100. Points in blue represent the organisms found downstream of Paradise Pond, while points in orange are those found upstream of the pond.

Literature Cited:

Sinton, J. 2002, April. A Short History of the Mill River Watershed 1650-1940.

Strayer, D. L., and D. R. Smith. 2003. A guide to sampling freshwater mussel populations. American Fisheries Society, Monograph 8, Bethesda, Maryland.

Wells, R. R., E. J. Langendoen, and A. Simon. 2007. Modeling Pre- and Post-Dam Removal Sediment Dynamics: The Kalamazoo River, Michigan1. JAWRA Journal of the American Water Resources Association 43:773–785.

SURF 2018-Post SURF Survey

Name	Katelyn Smalley
Year of Graduation	2021

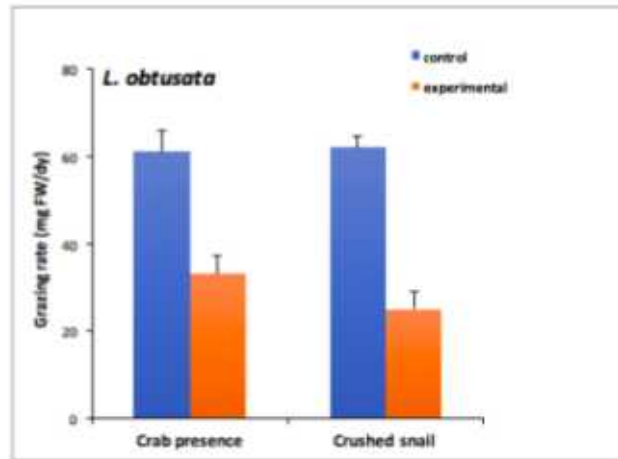|	
Are you in a Graduate program?	no
SURF Advisor	Paulette Peckol, Biological Sciences
Advisor Department	Biological Sciences
SURF Field of Study	Marine Biology
Please list co-authors of your abstract	Sarah Chin
Upload image(s) in .png format; 1,100 MB max size each	

Fig.1. Mean (±SE) grazing rate (mg FW/dy) of *L. obtusata* in the presence of *C. irroratus* (crab presence) and crushed conspecifics (*L. obtusata*). Grazing rate on *F. vesiculosus* was reduced significantly under both experimental treatments when compared with control rates.
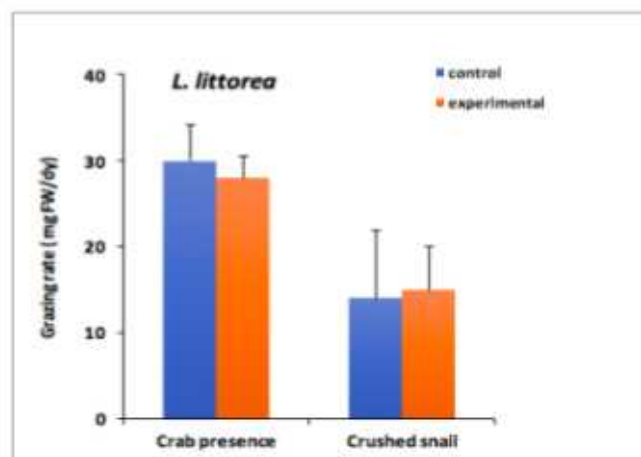

Fig. 2. Mean (±SE) grazing rate (mg FW/dy) of *L. littorea* in the presence of *C. irroratus* (crab presence) and crushed conspecifics (*L. littorea*). Grazing rate on *F. vesiculosus* did not vary significantly between control and experimental treatments.

IMG_3334.PNG

Title of Abstract/Research	The Great Escape: behavioral evasion adaptations of herbivorous gastropods Littorina littorea and L. obtusata in the presence of their predators, invasive Hemigrapsus sanguineus and Carcinus maenas, and native Cancer irroratus
Please type your abstract below.	Sarah Chin /2019, Katelyn Smalley/ AEMES 2021 Trophic level interactions between predator and prey shape the behavior and

livelihood of intertidal communities. In New England, the native species Carcinus maenas (Green Crab) and the invasive species Hemigrapsus sanguineus (Asian Shore Crab), have an impact on grazing rates of the native snail species Littorina obtusata and Littorina littorea. Past studies of the interactions between these species suggest that the grazing rates of L.littorea decreased only in the presence of C.maenas , while the grazing rates of L.obtusata decreased significantly in the presence of both C.maenas and H. sanguineus. Additionally it was suggested that L. obtusata may display a heightened vulnerability to predation due to their thinner shell thickness (Noe-Wilson, Chin et.al). In this study, we continued to explore these interactions with a focus on the distribution and shell adaptations that the the aforementioned herbivorous gastropods have maintained as a result of the negative impacts that have been imposed on their grazing rates.

Our research demonstrates that gastropods have adopted specific behaviors to combat disturbances caused by prey. Having examined the predation of both invasive crabs C. maenas and H. sanguineus, in addition to a native crab species Cancer irroratus , on L. littorea and L. obtusata, we then investigated whether a size refuge existed for either snail species. Laboratory experiments examined the potential for an escape in size by the gastropods. H. sanguineus was unable to consume L. littorea collected from the Jamestown site, while C. maenas (green crab) consumed few small L. littorea. We suspect that L.littorea may sustain a size refuge above ~ 9 mm. In contrast, both C.maenas consumed L. obtusata with ease, suggesting that it has no size refuge in the presence of this predator. However, L. obtusata did achieve escape in size above ~12 mm from predation by H. sanguineus. The large native crab, C. irroratus, did not consume either snail species. To further explore these snail adaptations, we conducted a lab experiment monitoring the grazing rates of L.obtusata and L. littorea on the algae Fucus vesiculosus while submerged in water containing C. irroratus and conspecific waterborn cues. L. obtusata showed lower grazing rates in the presence of both Rock crabs (t = 4.3, P = 0.007) and crushed L. obtusata (t = 2.75, P = 0.015) compared with the control treatment (Fig.). In contrast, L. littorea demonstrated a marginal reduction in grazing in the presence of its crushed conspecific (t = 1.89, P = 0.08), and no difference in herbivory in the presence of C. irroratus cues.

In the field, L. obtusata consistently occur in significantly greater densities in high intertidal areas, compared with mid- and low intertidal zones. Further, larger snails tend to be found in the lower regions. Given their vulnerability to predation highlighted in our lab experiments, we hypothesized that the species' distribution pattern might be affected by the presence of crab predators in the low intertidal and shallow subtidal areas. We took quadrat data to census initial densities of L. obtusata and selected areas with similar (t = 1.04, P = 0.31) snail abundances. To one quadrat, we added H. sanguineus to achieve ~5X higher crab densities than usually found at this site. We found a marginal effect of H. sanguineus addition. Although there was not a significant change in abundance in the control area, L. obtusata had a 52% reduction in density in the crab addition area (t = 1.79, P = 0.09). In contrast, L. littorea showed no significant change in abundance following crab addition. This short-term field experiment supports our lab work in highlighting impacts of crab predators on L. obtusata activity and distribution. We conclude that vulnerability to predation from crab predators place L. obtusata in a continuous state of vulnerability, because of its smaller size compared with L. littorea, and thus might contribute to its limited distribution and herbivory in rocky intertidal areas.

SURF 2018-Post SURF Survey

Name	Mairead Bartlett
Year of Graduation	2018

Are you in a Graduate program?	no
SURF Advisor	David Gorin, Chemistry
Advisor Department	Chemistry
SURF Field of Study	Chemistry
Upload image(s) in .png format; 1,100 MB max size each	
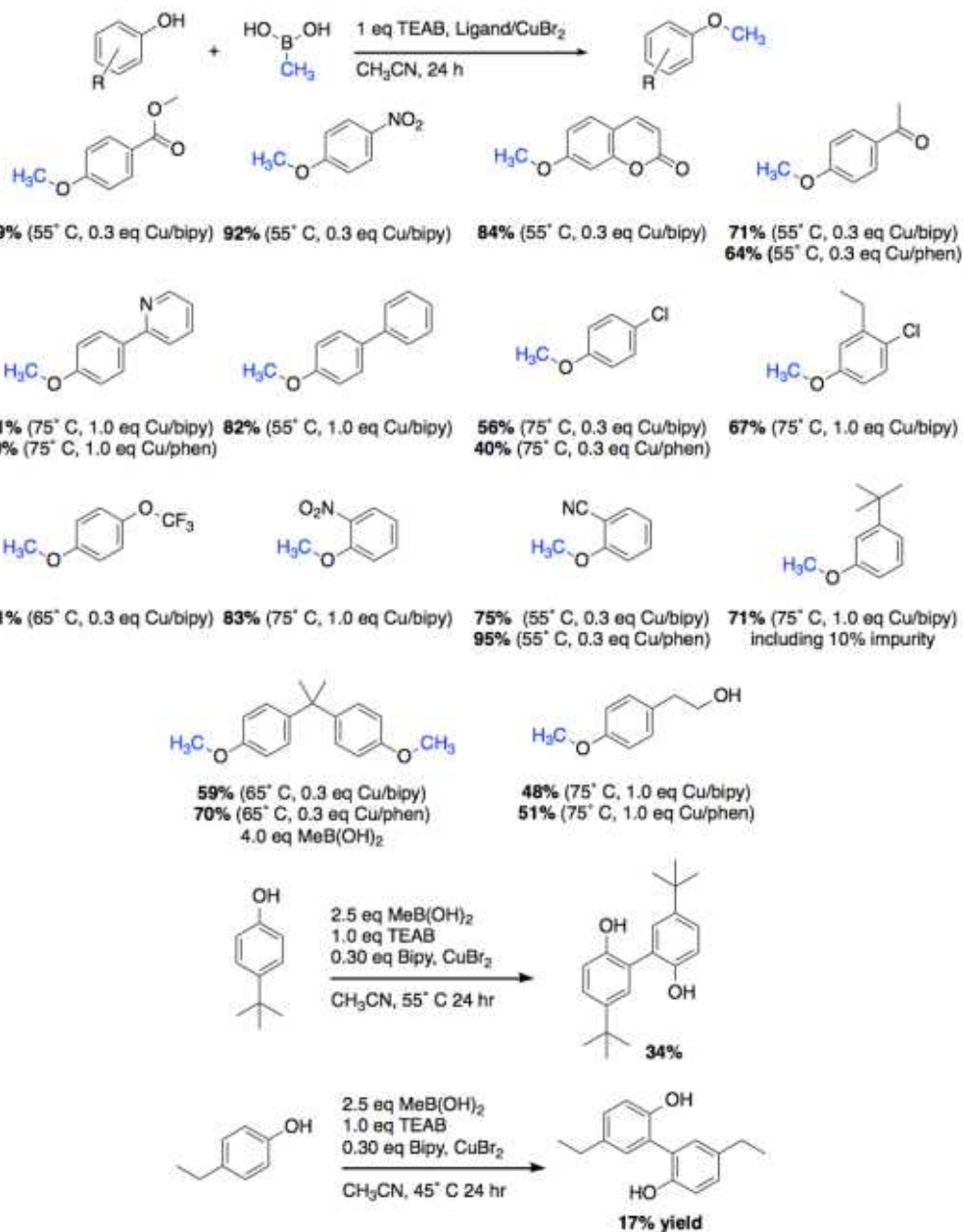
Bartlett M SURF figure.png

| **Title of Abstract/Research** | Chan-Lam Aerobic Methylation of Phenols |

Please type your abstract below.

Aryl methyl ethers are common in consumer products including pharmaceutical compounds that treat conditions from Alzheimer's to cancer to HIV (1). However current methodology focuses predominantly on electrophilic sources of methyl, using reagents such as diazomethane, TMS-diazomethane, methyl iodide, and dimethyl sulfate. While highly efficient, electrophiles are inherently toxic to humans, causing the death of multiple chemists since 2008, thereby signaling the need for an alternative, safe, regioselective methylating reagent to perform such reactions (2,3).

Our attention turned to nucleophilic sources of methyl that could be cross-coupled with atmospheric oxygen to avoid the inherent toxicity of electrophiles. The Chan-Evans- Lam reaction pairs a nucleophile with a boronic acid (most commonly an arylboronic acid) using a copper catalyst and an oxidant. There is limited precedent for alkylation, including only two examples of methylation to our knowledge, one using carboxylic acids, published by the Gorin lab, and one on nitrogen nucleophiles. After screening conditions of successful Chan-Lam alkylations, we were able to successfully methylate 4-fluorophenol. Optimization studies were performed using 19F NMR quantification.

The optimized conditions were tested on a variety of substrates to obtain isolated yields. Para-substituted electron-withdrawing groups (EWGs) underwent conversion most successfully, with isolated yields as high as 99%. We were able to successfully methylate ortho-substituted EWGs using the same conditions. When using weaker withdrawing groups or donating groups, the temperature and/or copper and ligand equivalents were increased to encourage conversion. However, many of these phenols still resist methylation, especially alkyl groups.

This summer we discovered evidence of homocoupling of electron-rich substrates when subjected to our typical conditions. We theorize the phenol is acting in these cases as a masked enolate to form the dimer structure, which would explain the difficulties encountered with methylating these substrates.

This work is currently being written into a manuscript for publication, and future investigation by special studies and thesis students may focus on transitioning to aliphatic alcohol methylation, or to C-H methylation of arenes or indoles.

(1) Modern Drug Synthesis; Li, J. J., Johnson, D. S., Eds.; Wiley: Hoboken, N.J, 2010.
(2) Enoch, S. J.; Ellison, C. M.; Schultz, T. W.; Cronin, M. T. D. A Review of the Electrophilic Reaction Chemistry Involved in Covalent Protein Binding Relevant to Toxicity. Crit. Rev. Toxicol. 2011, 41 (9), 783–802.
(3) Kemsley, J. FIRM FINED FOR CHEMIST'S DEATH. Chem. Eng. NEWS 2011, 89 (19), 15.

SURF 2018-Post SURF Survey

Name	Autumn Mineo
Year of Graduation	2019

Are you in a Graduate program?	no
SURF Advisor	Maren Buck, Chemistry
Advisor Department	Chemistry
SURF Field of Study	Polymer Chemistry
Upload image(s) in .png format; 1,100 MB max size each
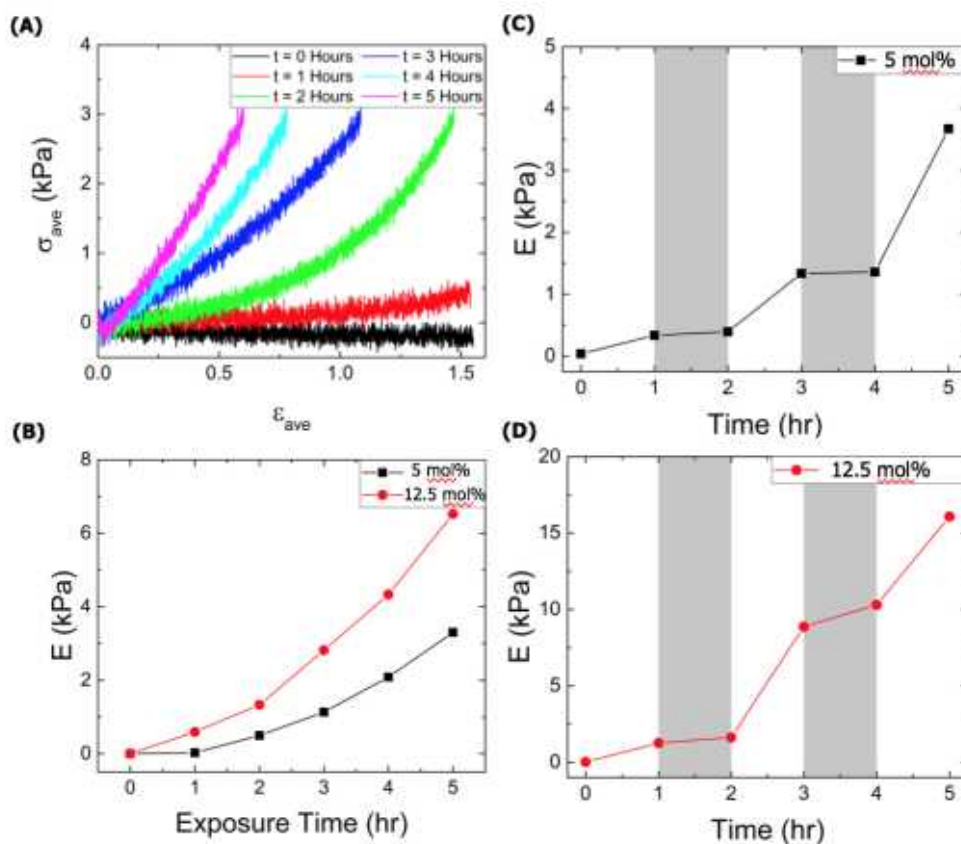
SURF image.png |
| **Title of Abstract/Research** | Photocontrolled ring opening reactions of poly(2-alklenyl azlactone)s with photocaged amines for hydrogel formation and modification |

Please type your abstract below.

The bulk of Dr. Buck's previous research is based on various applications of azlactone-functionalized polymers with particular interest in the radically initiated polymerization of 2-vinyl-4,4-dimethylazlactone (VDMA) to synthesize poly(2-vinyl-4,4-dimethylazlactone) (PVDMA). Unique to PVDMA networks, post-polymerization ring opening reactions are possible in the presence of nucleophiles, such as primary amines, alcohols, or thiols (1). Traditionally, the Buck lab uses uncontrolled post-polymerization reactions with nucleophilic species to promote crosslinking and subsequent hydrogel formation. These reactions occur rapidly, often before proper mixing and dispersion can happen, which results in heterogeneous crosslink density throughout the matrix. Additionally, the speed of gelation creates difficulty in specific shape gel casting, especially at high crosslink concentrations. My research has focused on using a photolabile primary amine protecting group to introduce temporal and spatial control into matrix formation and modification. Post-polymerization crosslinking and functionalization reactions between PVDMA networks and photocaged primary amines are initiated by UV irradiation, via the degradation of 2-nitrobenzyl photolabile primary amine protecting groups (2). Introducing control over the time of gelation and the speed of gelation improves the homogeneity of gel matrices and the production of shape specific gels. Spatial control allows for two dimensional and three dimensional topographic patterning, patterning of local chemical behavior such as swelling and contraction, and selective crosslinking and degradation. Temporal and spatial control over hydrogel networks allow for the possible engineering of complex cellular directing scaffolds and polymeric tissue mimics.

Successful synthesis of photoprotected diamine species, di 2-(2-nitrophenyl)propyloxycarbonyl hexamethylenediamine and di 2-(2-nitrophenyl)propyloxycarbonyl poly(ethylene glycol) diamine, was determined by hydrogen nuclear magnetic resonance spectroscopy with reasonable purity (3, 4, 5). In addition, complete degradation of both photoprotected species was observed by 1H NMR by 60 minutes of UV exposure (hv = 365 nm, power = 0.2 mW/cm2). As anticipated, a tangible matrix was formed when photocaged diamine was added to a solution of PVDMA and exposed to adequate irradiation, indicating a reaction between the photoliberated diamine crosslinker and the PVDMA backbone. The progression of gelation was monitored by infrared spectroscopy and low strain mechanical testing. IR control samples of PVDMA in dimethylsulfoxide demonstrated that the PVDMA backbone was stable under UV irradiation, while time studies of PVDMA/photocaged diamine samples demonstrated continued crosslinking with irradiation time, evident by the decreasing intensity of the 1820 cm^-1 peak representing the carbonyl bond in the azlactone repeat units of PVDMA.

Below is low strain contact data from flat probe indentation showing increasing stiffness with irradiation time where (A) is raw data of resistance force/probe displacement curves as exposure time increases in a 5 mol% photocaged PEG crosslinker sample and (B) is the elastic moduli of PVDMA/photocaged PEG matrices with continuous irradiation of 5 and 12.5 mol% crosslinker samples. Notice that the slope in figure A is increasing with exposure time, which signifies mechanical stiffening, and figure B shows an increasing elastic moduli over time indicating the mechanical properties of the samples switching from a liquid-like state to a solid-like state. Figures (C) and (D) show the elastic moduli of PVDMA/photocaged PEG matrices with alternating periods of irradiation for 5 and 12.5 mol% crosslinker respectively. The white areas indicate intervals where the samples experience UV light, while the dark segments indicate intervals where the samples are not exposed to light. Notice the flat slopes in the dark segments, which indicate that the mechanical properties of the samples are not changing when the sample is not exposed to light, demonstrating light controlled crosslinking.

An additional immediate goal of my research is to reproduce the data collected this summer to gather statistical significance for intended publication. Areas of further study include light initiated patterning of gel networks through site selective chemical functionalization, gradients in mechanical stiffness, and post fabrication degradation as visualization of selective patterning.

(1) Buck, Maren; Lynn, David. Polym. Chem., 2012, 3, 66.
(2) Xi, Weixian; Krieger, Matthias; Kloxin, Christopher; Bowman, Christopher. Chem. Commun., 2013, 49, 4504.
(3) DeForest, C. A.; Tirrell, D. A. Nature Materials. 2015, 14 : 523-530.
(4) Clerc, J.; Schellenberg, B.; Groll, M.; Bachmann, A.; Huber, R.; Dudler, R.; Kaiser, M. Eur. J. Org. Chem. 2010, 3991-4003.
(5) Rathore, O.; Winningham, M. J.; Sogah, D. Y. J. Poly. Sci. 2000, 38 : 352-366.

SURF 2018-Post SURF Survey

Name	Elizabeth Van Winkl
Year of Graduation	2019

SURF Advisor	Peter de Villiers, Psychology
Advisor Department	Psychology
SURF Field of Study	Child Development and Language Acquisition
Upload image(s) in .png format; 1,100 MB max size each	fixed abstract photo.png
Title of Abstract/Research	Development of Children's Categorization of Facial Expressions: Are Emotion Adjectives Relative or Absolute?

Please type your abstract below.

Adjectives can be grouped into two categories: relative, where context determines whether the adjective applies to the noun; and absolute, where context doesn't determine whether the adjective applies to the noun. Many types of adjectives have been determined to be either relative or absolute, however, only recently have researchers begun to examine where emotion adjectives fit into this model.

Previously, Peter de Villiers found that adults use emotion adjectives as relative adjectives. But when do children understand that emotion adjectives are relative? Children were given either 9 or 13 pictures of faces that ranged from neutral to happy and were instructed to give the experimenter all the happy faces. The range of 13 faces, however, were skewed more toward the happy end of the spectrum. Therefore, when selecting which faces were happy, children in the condition with 9 photos chose a cutoff point around the fifth picture, but in the 13 condition, a new cutoff point was established, and some of the pictures that had been previously classified as happy were now not considered happy. This shows that children understand that emotion adjectives are relative. However, only four and five-year-olds performed this way. Three-year-olds, in contrast, were able to understand the difference between absolute and relative but did not sort the emotion faces as relative – in fact they would often skip over faces in the spectrum (e.g. choose the fifth picture on the spectrum, then skip over the sixth and seventh, and choose the eight and ninth as happy).

Why do three-year-olds fail at this task – is it because they don't understand the adjectives, don't understand the task, or don't understand the spectrum of emotion (from neutral to happy)? This is something I will explore in my thesis this upcoming year.

In addition, we investigated whether children saw emotion adjectives as relative by asking them if we could use a definite article with the adjective (which would imply that it's absolute, not relative). Four and five-year-olds said it was okay to use a definite article with emotion adjectives, which contradicts our results for the previous experiment. We theorize that part of this has to do with the task demands, especially in the younger children, but are not sure why we are finding these contradictory results.

SURF 2018-Post SURF Survey

Name	Mackenzie Litz
Year of Graduation	2020

Are you in a Graduate program?	no
SURF Advisor	Michael Baressi, Biological Sciences
Advisor Department	Biological Sciences
SURF Field of Study	Biology
Title of Abstract/Research	Taking a Roundabout Investigation of the Forebrain: Testing the Requirements of robo1 and robo4 in Zebrafish Forebrain Development
Please type your abstract below.	Many signals and receptors coordinate their functions to facilitate the building of a brain. A critical step in brain development is the connection of the two halves of the nervous system through midline crossing axons forming structures called commissures. The accessibility, transparency, fast development, and genetic and molecular techniques of the zebrafish model organism provides a tractable system to study the first commissure to form in the brain called the post optic commissure (POC). POC formation relies on Slit repellent guidance cues, Slit1a/2/3 and Roundabout receptors (Robos), Robo1-4, and current studies show that slit2/3 and robo2/3 are involved in axon repulsion. We seek to decipher the distinct ways in which the different robos may be mediating differential slit signaling. Although robo2 and robo3 have been previously reported to impact optic chiasm formation and hindbrain development respectively, little is known about their role in POC formation and nothing is understood about robo1 or robo4. Morpholino knockdown studies suggest that Robo1 may serve as the receptor for Slit1a signaling. In addition, we have been interested in how intimately POC axons associate with astroglial cells at the midline during crossing. Interacting astroglial cells exclusively express robo4, unlike the POC neurons. Robo4 has been implicated in angiogenesis which suggests it may play a role in the formation of the blood brain barrier (BBB). To characterize the role of robo1 and robo4 we have created knockouts in these receptors. robo4 mutants show subtle phenotypes in POC formation and glial bridge condensation. We will also implement a newly developed computational method, DeltaSCOPE, to quantify both robo1 and robo4 mutant POC phenotypes as well as extend this analysis to the BBB. We intend to utilize these techniques to fully investigate the Slit-Robo code of axon guidance and elucidate an important mechanism required for brain development.

SURF 2018-Post SURF Survey

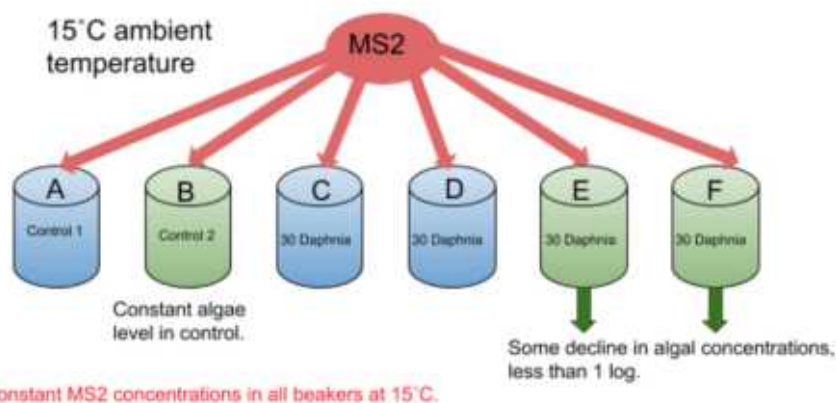|	
Name	Emma Underdah
Year of Graduation	2020
Are you in a Graduate program?	no
SURF Advisor	Niveen Ismail, Engineering
Advisor Department	Engineering
SURF Field of Study	Environmental Engineering
Please list co-authors of your abstract	Vivian Nelson
Upload image(s) in .png format; 1,100 MB max size each	Figure 1. Diagram of MS2, Daphnia and algae experiments completed at 15˚C. Beakers A and B are controls; A contains 80 mL Moderately Hard Synthetic Freshwater (MHSFW) plus MS2 and B contains 40 mL MHSFW, MS2 and 40 mL algae. C and D contain 80 mL MHSFW, MS2 and 30 Daphnia. E and F contain 40 mL MHSFW, MS2, 40 mL algae and 30 Daphnia. All beakers were aerated. MS2 concentrations in all beakers remained steady. eunderdah diagram.png
Title of Abstract/Research	Examining the Potential of Using Zooplankton to Remove MS2 Virus in Natural Systems

Please type your abstract below.

Microbial pollutants, such as bacteria and viruses, are a leading cause of impaired waterways and novel approaches are needed to remove them from natural systems. MS2 is a bacteriophage which may be used to model viruses. Although MS2 is not presently regulated by the United States Environmental Protection Agency, its ability to be modeled as a virus may make it an effective indicator of contaminated water. Zooplankton are small filter feeding organisms which may be abundant in natural systems and have the potential to be used for removal of microbial pollutants. Previous studies in the Ismail lab have found up to 5 log removal of Escherichia coli from fresh water sources by zooplankton, but little is known about the ability of these organisms to remove viruses from freshwater.

This research investigates the behavior of MS2 in freshwater and examines how the freshwater zooplankton Daphnia magna may remove MS2. Studies were completed to examine the impact of temperature on MS2 and the sorption potential of MS2 on the freshwater algae Nannochloropsis sp, which is a food source for D. magna. In addition, feeding studies were completed to determine the impact of D. Magna on MS2 concentration. Results from these preliminary experiments show that MS2 concentrations are more stable at lower temperatures and MS2 does sorb on Nannochloropsis sp.. Initial experiments with D. magna do not show significant uptake of MS2 but additional experiments using different experimental conditions are needed.

SURF 2018-Post SURF Survey

Name	Ziwei Zang
Year of Graduation	2020

Are you in a Graduate program?	no
SURF Advisor	Miles Ott, Statistical and Data Sciences
Advisor Department	Statistical and Data Sciences
SURF Field of Study	Statistics
Title of Abstract/Research	Is Marijuana Use Related to Popularity? A Social Network Analysis Of College Students

Please type your abstract below.

Background and Objectives: Marijuana use among college students was found to associate with use of substance by friends, but no investigation of marijuana use and popularity among college students using social network analysis have been conducted. Marijuana users were more likely to have smoked cigarettes and to have engaged in binge drinking, but simultaneous investigations of peer associations with marijuana use and use of tobacco and alcohol among college students have not been conducted.

Research Design and Methods: Using peer network of first year college students to examine the association between marijuana use and popularity. 1257 first year students from a private university completed a Web-based survey of substance use and nomination of up to 10 people who were important to them, and up to 3 best friends among 10 important people. Network autocorrelation model was used to investigate the association between marijuana use and popularity, accounting for the interaction among participants. Particularly, two sociocentric networks--Network of Important People and Network of Best Friend--were built to compare peer influence of different type of friendship on marijuana use.

Results: Participants nominated an average of 5.62 students as important people and 0.85 students as best friends. 48.7% (N=612) students have used marijuana and 26% (N=326) students have used marijuana at least twice in the past thirty days, identified as recent marijuana users. Recent marijuana use had a positive association with popularity after controlling for covariates, including demographic and socioeconomic status. Moreover, the association differed by binge drinking and smoking. Multiple substance users had negative association with popularity compared to students who only used marijuana. Recent marijuana users had higher popularity score as important people than as best friends.

Discussion and Implication: Social network of first year college students might be useful for social behavior studies of substance use among adolescents and young adults. This analysis provides quantitative evidence of peer influence as an effect of social contact on drug use. Future prevention and intervention on adolescents' marijuana use might consider modifying social environment.

SURF 2018-Post SURF Survey

Name	Abigail Lown **Smith**
Year of Graduation	2019
Are you in a Graduate program?	no
SURF Advisor	Amy Rhodes, Geosciences
Advisor Department	Geosciences
SURF Field of Study	Geosciences
Please list co-authors of your abstract	Darren Gravley, University of Canterbury, Christchurch NZ; Amy Rhodes, Smith College, Northampton MA.
Title of Abstract/Research	Exploring Bulk Rock Geochemical Controls on Formation of Volcanic "Benches" at Pigeon Bay Peak, Banks Peninsula NZ

Please type your abstract below.

Distinct mineralogical, textural and geochemical variation is present among separate stacked lava flows from the Miocene-aged Akaroa Volcanic Complex on New Zealand's South Island. The complex, known colloquially as Banks Peninsula (BP), displays geomorphological features referred to as 'volcanic benches' above the bays. The factors that controlled the formation of these 'benches' are not fully understood by geologists studying this volcanic peninsula, as there is no known evidence for tectonic uplift since volcanism ceased. The features appear as large scale, flat, step-like surfaces that break the steep slope of the hillsides and form at the contact between stacked lava flows. This study aims to evaluate the theory that there is a relationship between the bulk geochemistry of separate basalt lava flows and the formation of these geomorphic 'benches'. Geochemical analyses using Portable X-Ray Fluorescence (PXRF) of separate lava flow transects from Eastern Pigeon Bay (EPB) and Pigeon Bay Peak (PBP) show variation in elemental composition between separate flows, suggesting that primary magmatic bulk rock geochemistry influences bench formation on the peninsula. Preliminary textural analysis suggests that more resistant bench-forming flows may be finer-grained (aphyric) and more uniform-textured than inter-bench flows. Additional whole rock XRF analysis, scanning electron microscopy (SEM), and lab reactions between rainwater and crushed rock samples compared geochemistry of fresh and weathered basalt to better understand chemical mineral weathering of these separate lava flows. Comparison of these data sets showed significant differences between Mg:Ca and Mg:Na ratios for whole rock and rainwater chemical compositions between fresh and weathered basalts. These observations suggest that Mg-Fe bearing minerals (olivine and clinopyroxene) are more susceptible to weathering than the main Na-Ca bearing mineral present in the basalts, plagioclase feldspar (An50). Greater understanding of chemical weathering processes for these basalts will lead to more insight into the erosional process and formation of the bench features found on Banks Peninsula.

SURF 2018-Post SURF Survey

Name	Chhiring Lama
Year of Graduation	2021

Are you in a Graduate program?	no
SURF Advisor	Elizabeth Jamieson, Chemistry and Biochemistry
Secondary SURF Advisor	Cristina Suarez
Advisor Department	Biochemistry
SURF Field of Study	Biochemistry
Please list co-authors of your abstract	Ruby Wu, Alisha Shrestha

Upload image(s) in .png format; 1,100 MB max size each

Capture.PNG

Title of Abstract/Research	Spiroiminodihydantoin Lesion Synthesis and Analysis of Thermodynamic Stability of mismatched DNA Using UV/VIs Spectroscopy
Please type your abstract below.	DNA contains the genetic information needed to sustain life. When DNA is damaged, cancer and neurodegenerative diseases can result. This summer, we investigated two different types of DNA damage. The first type, the spiroiminodihydantoin (Sp) lesion, forms when a guanine nucleobase is oxidized. The second type of damage investigated was the effect of having a DNA mismatch (a non-Watson-Crick base pairing partner) on the DNA duplex. The thermodynamic stability (ΔH, ΔS and ΔG) of mismatched versus normal DNA was calculated using data acquired through melting temperature (Tm) experiments on a UV-Vis spectrophotometer. The major findings from these experiments are shown in Figure 1 and will allow us to better understand how mismatches affect the stability of DNA duplexes. In preparation for 2-D NMR Nuclear Overhauser Effect Spectroscopy (NOESY) studies comparing control and damaged DNA, an 11-mer DNA strand containing 8-oxo-guanine was oxidized using sodium persulfate and sodium bicarbonate. The two diastereomeric lesions, Sp1 and Sp2, were identified using mass spectrometry, collected, and purified using HPLC, giving a yield of 46%. The material collected will be used for future NMR experiments on Sp lesion containing DNA duplexes

SURF 2018-Post SURF Survey

Name	Marcela Rodrigues
Year of Graduation	2020

Are you in a Graduate program?	no
SURF Advisor	Annaliese Beery, Psychology
Advisor Department	Neuroscience
SURF Field of Study	Neuroscience
Please list co-authors of your abstract	Natalie Bourdon '19
Upload image(s) in .png format; 1,100 MB max size each	

Dams on diet 3 weeks before mating

Pups born
Day 0

Maternal Care Observation
Day 1-7

Play Behavior Test
Day 33

Anxiety Tests
Day 55+

Sociability Test
Day 60-65

Partner Preference Test
Day 70+

Allergy Induced Asthma Testing
Day 90+

Tissue Analysis

NBourdon MRodrigues SURF Abstract Image.png

Title of Abstract/Research	The Effects of Dietary Gestational Folic Acid on Adult Behavior in Rats

| **Please type your abstract below.** | The Effects of Dietary Gestational Folic Acid on Adult Behavior in Rats |

Natalie Bourdon '19 and Marcela Rodrigues '20J
Advisor: Annaliese K. Beery

Folic acid is a B vitamin crucial for healthy fetal development. Studies have shown that a sufficient level is required for the successful closure of the neural tube, which has led to the fortification of many grain-based products in the United States, as well as its inclusion in prenatal dietary supplements (CDC 1991). Yet, the additional impacts of gestational folic acid are still being studied, with potential correlations to Autism Spectrum Disorder and respiratory conditions such as asthma (Barua 2016). Additionally, folic acid has been found to be a methylating agent, and has epigenetic effects (Dolinov 2007). This study is hoping to investigate the effects of dietary gestational folic acid on epigenetic changes, social and anxiety behavior, and respiratory function in adult Long-Evans rats.

Rat dams were fed one of three diets, each containing a different dose of folic acid - a low 0.3 mg/kg diet, a medium 2 mg/kg diet, and a supplemented 10 mg/kg diet. They were maintained on these diets for at least three weeks prior to their pregnancy, during gestation, and until the weaning of their offspring. Rat pups were moved to a control diet at weaning. Epigenetic analysis will be done on tissue collected from pups on the day of birth, and respiratory analysis will be completed through the use of an allergy induced asthma model in adult rats (Schwartzer 2017). The effects on behavior will be measured through the use of a play behavior test, sociability test, open field test, light/dark box test, and partner preference test.

Researchers are looking to find behavioral and physiological changes between dietary groups. It is expected that this study will show a decrease in social behavior in rats that were exposed to a low amount of folic acid during gestation, and an increase in respiratory problems in rats that were exposed to a high level of folic acid during gestation. Additionally, researchers are looking to see potential changes in methylation patterns in selected genes related to social behavior. Research is ongoing into the fall semester, and a follow up study will be run using prairie voles.

Sources:
Barua S, Kuizon S, Ted Brown W, Junaid MA (2016) High Gestational Folic Acid Supplementation Alters Expression of Imprinted and Candidate Autism Susceptibility Genes in a sex-Specific Manner in Mouse Offspring. Journal of Molecular Neuroscience 58:277–286.
Centers for Disease Control (CDC) (1991) Use of folic acid for prevention of spina bifida and other neural tube defects--1983-1991. MMWR Morb Mortal Wkly Rep 40:513–516.
Dolinoy DC, Huang D, Jirtle RL (2007) Maternal nutrient supplementation counteracts bisphenol A-induced DNA hypomethylation in early development. Proceedings of the National Academy of Sciences 104:13056–13061.
Schwartzer JJ, Careaga M, Coburn MA, Rose DR, Hughes HK, Ashwood P (2017) Behavioral impact of maternal allergic-asthma in two genetically distinct mouse strains. Brain Behav Immun 63:99–107.

SURF 2018-Post SURF Survey

Name	Natalie Bourdon
Year of Graduation	2019
Are you in a Graduate program?	no
SURF Advisor	Annaliese Beery, Psychology
Advisor Department	Neuroscience
SURF Field of Study	Neuroscience
Please list co-authors of your abstract	Marcela Rodrigues '20J
Upload image(s) in .png format; 1,100 MB max size each	

Dams on diet 3 weeks before mating

Pups born
Day 0

Maternal Care Observation
Day 1-7

Play Behavior Test
Day 33

Anxiety Tests
Day 55+

Sociability Test
Day 60-65

Partner Preference Test
Day 70+

Allergy Induced Asthma Testing
Day 90+

Tissue Analysis

NBourdon MRodrigues SURF Abstract Image.png

Title of Abstract/Research	The Effects of Dietary Gestational Folic Acid on Adult Behavior in Rats

Please type your abstract below.	The Effects of Dietary Gestational Folic Acid on Adult Behavior in Rats

Natalie Bourdon '19 and Marcela Rodrigues '20J
Advisor: Annaliese K. Beery

Folic acid is a B vitamin crucial for healthy fetal development. Studies have shown that a sufficient level is required for the successful closure of the neural tube, which has led to the fortification of many grain-based products in the United States, as well as its inclusion in prenatal dietary supplements (CDC 1991). Yet, the additional impacts of gestational folic acid are still being studied, with potential correlations to Autism Spectrum Disorder and respiratory conditions such as asthma (Barua 2016). Additionally, folic acid has been found to be a methylating agent, and has epigenetic effects (Dolinov 2007). This study is hoping to investigate the effects of dietary gestational folic acid on epigenetic changes, social and anxiety behavior, and respiratory function in adult Long-Evans rats.

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Researchers are looking to find behavioral and physiological changes between dietary groups. It is expected that this study will show a decrease in social behavior in rats that were exposed to a low amount of folic acid during gestation, and an increase in respiratory problems in rats that were exposed to a high level of folic acid during gestation. Additionally, researchers are looking to see potential changes in methylation patterns in selected genes related to social behavior. Research is ongoing into the fall semester, and a follow up study will be run using prairie voles.

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Dolinoy DC, Huang D, Jirtle RL (2007) Maternal nutrient supplementation counteracts bisphenol A-induced DNA hypomethylation in early development. Proceedings of the National Academy of Sciences 104:13056–13061.
Schwartzer JJ, Careaga M, Coburn MA, Rose DR, Hughes HK, Ashwood P (2017) Behavioral impact of maternal allergic-asthma in two genetically distinct mouse strains. Brain Behav Immun 63:99–107.

SURF 2018-Post SURF Survey

Name	Duncan Peterson **Smith**
Year of Graduation	2020

Are you in a Graduate program?	no
SURF Advisor	Kevin Shea, Chemistry
Advisor Department	Chemistry
SURF Field of Study	Chemistry
Title of Abstract/Research	Synthesis of novel anesthetics

Please type your abstract below.

I would like to preface this by saying that I go to Carleton College, but they paid for me to allow me to work in Kevin Shea's lab.

In my project, I was working with both Adam Hall and Kevin Shea to attempt to design novel anesthetics. In my part of the project, I was doing research and attempting to fluorinate propofol in the para position. Most of my attempts were done with one fluorinating reagent (N,N-difluoro-2,2-dipyridinium), which proved mostly unsuccessful. Only small amounts of the product were seen, and these resisted purification attempts. There are now two additional fluorinating reagents in the Shea fridge, and I have high hopes that the 3,5-dichloro-N-fluoropyridinium will prove more effective. In addition to this, I was also attempting to create a 7 member version of propofol (2,7-diisopropyl-2,4,6-cycloheptatriene-1-one). My first attempt to do this was via a ring expansion using methyl lithium and DCM. This proved ultimately successful, but not on an effective scale. From NMR, it seemed as though 5-10% of the propofol was converted into product. I guess this could be followed up on, but it would have to be on a larger scale. For my other attempt, I started with a 7-member skeleton (Tropolone) and added on the groups that would make the molecule that I wanted. This entailed first using SOCl2 to change out an alcohol for a -Cl, and then adding isopropyl grignard. As of now, I am still unsure of if the isopropyl grignard added in the proper position, although there is some NMR data. I would suggest maybe using 2D techniques to see where it added.

SURF 2018-Post SURF Survey

Name	Emily Halstead
Year of Graduation	2019

Are you in a Graduate program?	no
SURF Advisor	Annaliese Beery, Psychology
Advisor Department	Neuroscience
SURF Field of Study	Neuroendocrinology
Upload image(s) in .png format; 1,100 MB max size each	Screen Shot 2018-08-16 at 3.26.49 PM.png
Title of Abstract/Research	Quantifying Social Reward in Prairie Voles
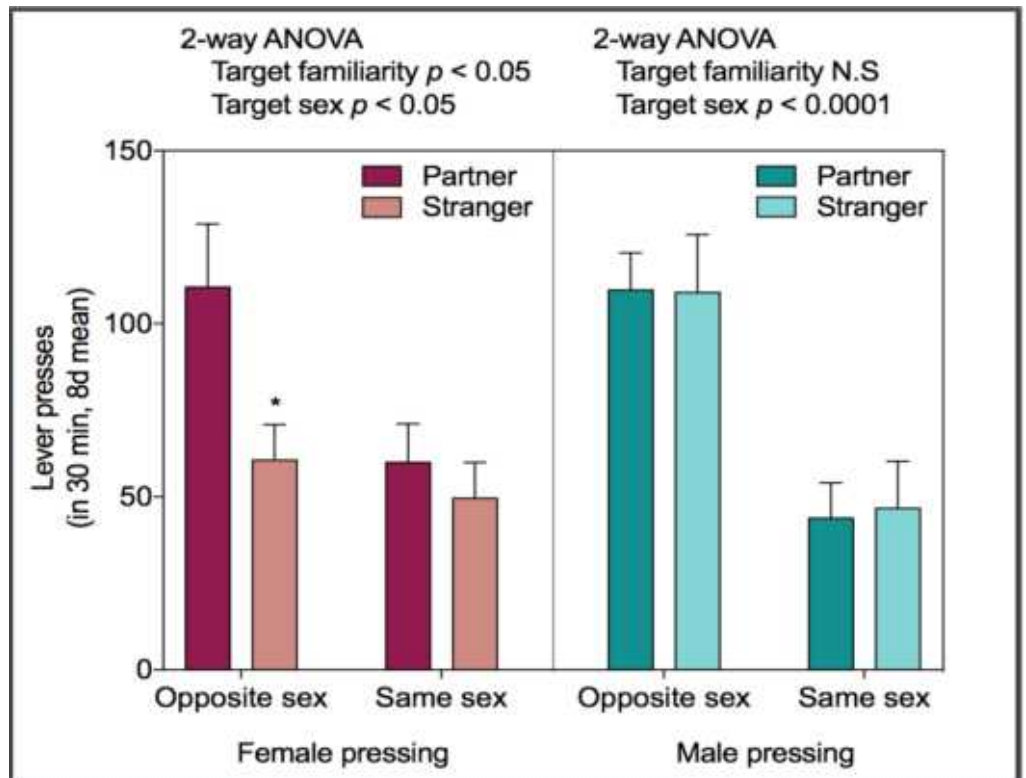
Please type your abstract below.

In recent decades the popularity of the use of prairie voles (Microtus ochrogaster) and meadow voles (Microtus pennsylvanicus) in neuroscientific and behavioral research has grown. This increase stems in part from the unique differences between the two species. The prairie vole is monogamous, meaning that parental care and mate protection are shown by the male and both sexes take a single mate. Comparatively, the meadow vole has a polygynous mating system, but has been shown to form peer bonds (Anacker and Beery 2013). Given the unique differences between the species, research has been conducted to examine how and to what extent these bonds are rewarding using operant conditioning.

A study conducted using both male and female, prairie and meadow voles suggests that the voles can experience social reward when pressing a lever to open a chamber containing another vole--either a mate, peer, or stranger vole. The preliminary results for the prairie voles can be found in Figure 1. These results suggest to us that female voles work harder to gain access to familiar males than to unfamiliar ones. Males did not show preference for familiar or unfamiliar voles of the opposite sex, but did show preference for a member of the opposite sex as compared to a peer. The results of the study showing evidence for social motivation have given rise to a follow up pilot study. The use of haloperidol, a dopamine antagonist, has been shown to block the formation of bonds among voles (Wang et. Al). The pilot experiment was designed to see if an intraperitoneal haloperidol injection could block the motivation to lever press. The pilot voles had been used as focal voles in the aforementioned lever pressing study. The voles were placed back into testing under one of the previously used paradigms in which they pressed for their partner at a progressive ratio. The pilot was designed in two phases; the first involved an alternating injection schedule of haloperidol and control solution, while the second phase split the pilot animals into two groups, half to receive the control injection and half to receive the haloperidol injection. Both groups pressed for a minimum of four days in phase two. The results of the pilot will inform whether haloperidol impacts social motivation in voles and could give rise to a larger study in the future.

1. Anacker AMJ, Beery AK (2013) Life in groups: the roles of oxytocin in mammalian sociality. Front Behav Neurosci 7:185.
2. Wang, Z., Yu, G., Cascio, C., Liu, Y., Gingrich, B., & Insel, T. R. (1999). Dopamine D2 receptor-mediated regulation of partner preferences in female prairie voles (Microtus ochrogaster): A mechanism for pair bonding? Behavioral Neuroscience, 113(3), 602-611.

Figure 1:Results of Lever Pressing Study Comparing Male and Female Prairie Voles Pressing for Opposite and Same Sex Partners and Strangers

SURF 2018-Post SURF Survey

Name	Grace Irungu
Year of Graduation	2020

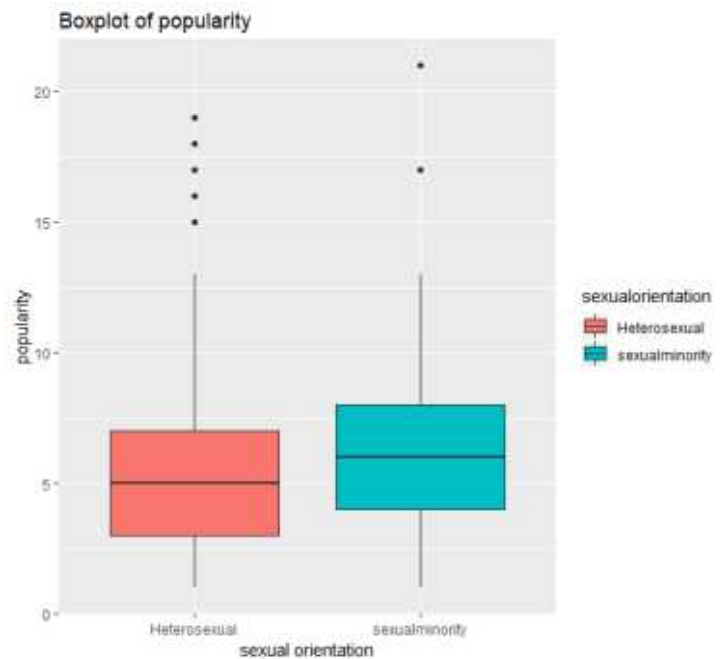|	
Are you in a Graduate program?	no
SURF Advisor	Miles Ott, Statistical and Data Sciences
Advisor Department	Statistical and Data Sciences
SURF Field of Study	Biostatistics

Upload image(s) in .png format; 1,100 MB max size each
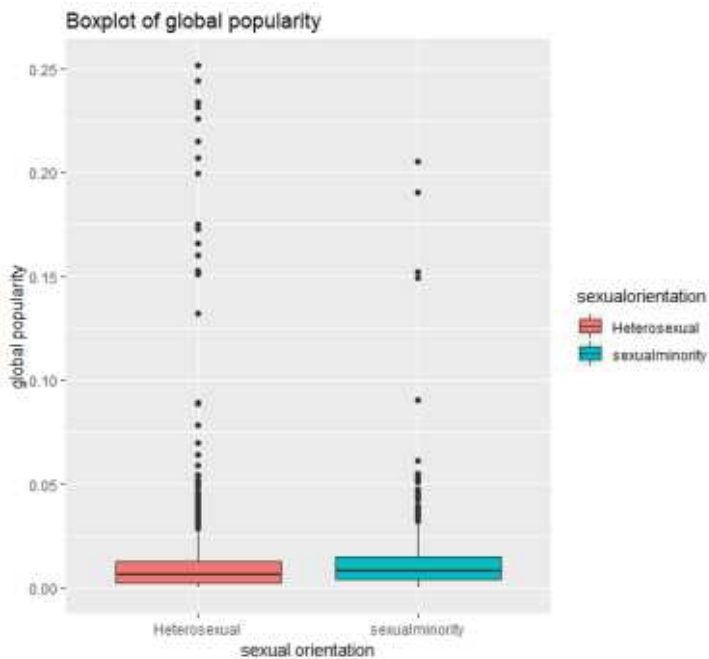
GLOBAL POPULARITY.png

Rplot06.png

Boxplot of sociability
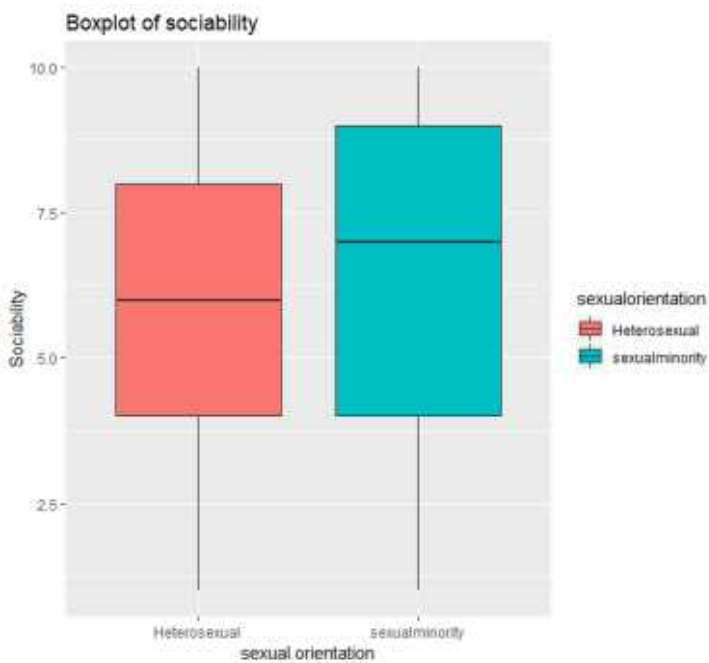
Rplot08.png

Title of Abstract/Research	Social Network Analysis of LGBTQ+ Community in a College Network: What is the difference between Popularity, Social Interaction and Social Influence of college students based on their Sexual Orientation?

Please type your abstract below.

ABSTRACT

Introduction - Over the years, the visible population of the people in the LGBTQ+ community in the United States has been increasing as seen with the increase of same-sex marriages in the country (Simmons,. et al 2003). With this comes and increase in both explicit and implicit stigma and prejudice against people within the LGBTQ+ Community. Sexual minorities tend to face more stigma and are more affected by the social environment stressors(Conron et al., 2010) compared to heterosexuals. However, very few studies have looked at how sexual orientation is associated with local popularity, sociability and global popularity and how the stigma and social stressors could affect the above.

Objectives - We used data of first years from a mid - sized college to examine the association between sexual orientation and local popularity, sociability, and global popularity amongst first-year college students, and whether the association between local popularity and sexual orientation differed by whether received financial aid or not and by whether the subject had anxiety and depression or not.

Methods - We analyzed data using network autocorrelation models and used two-sided P-values to measure whether the variables and interaction terms in our models were statistically significant or not.

Results - From our analysis we found that people who receive financial aid tend to be less popular compared to people who did not receive financial aid. We also found that people who identify as Gay/Lesbian/Bisexual tend to on average have a high anxiety and depression score compared to heterosexuals and that local popularity differs by sexual orientation in first year college students. However, we could not make an inference from the results we got from the analysis between the association of sexual orientation and sociability as well as global popularity and whether the association between local popularity and sexual orientation differs by financial aid and anxiety and depression.

Conclusions - Our results suggested the need for more intervention and support groups for people within these sexual minority groups to help them cope with anxiety and depression and for people who receive financial aid to help them make friends regardless of the socioeconomic status. Given the small sample size of the Questioning and Other groups in our analysis, in future we want to combine the Gay/ Lesbian/Bisexual bisexual group with the questioning and other groups into one group (sexual minority group) and conduct our analysis again.

SURF 2018-Post SURF Survey

Name	Sarita Chiu
Year of Graduation	2018

Are you in a Graduate program?	no
SURF Advisor	Paulette Peckol, Biological Sciences
Advisor Department	Biological Sciences
SURF Field of Study	Ecology
Upload image(s) in .png format; 1,100 MB max size each	
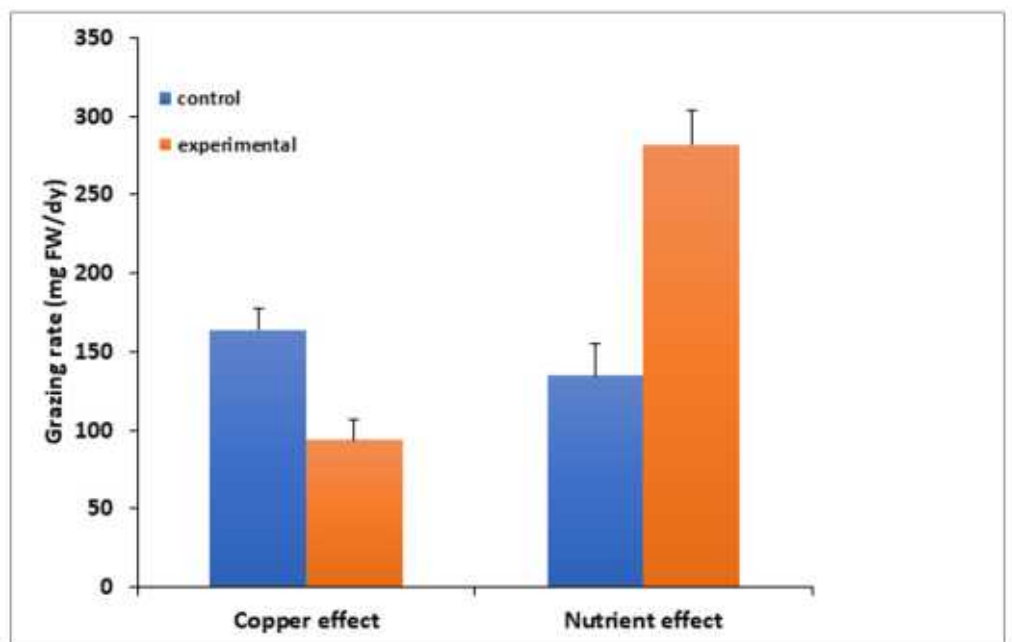
Fig. 1. Mean (+SE) grazing rates (mg FW/dy) of *Littorina littorea* on *Ulva lactuca* grown under high Cu concentrations (100 µg/L) or elevated nutrient levels (from fertilizer runoff) compared with control (ambient) conditions. *L. littorea* had significantly lower herbivory on *U. lactuca* with elevated Cu levels compared with control values, and higher grazing rates on *U. lactuca* from the site exposed to elevated nutrient levels relative to control values.

Graph for Abstract (Sarita Chiu).png

Title of Abstract/Research	Discriminating palate: effects of bioremediation characteristics of Ulva spp. on herbivory by the intertidal snail Littorina littorea

Please type your abstract below.

Ulva spp. are abundant opportunistic macroalgae in coastal habitats. Ulva plays several roles in these environments, including bioremediation of heavy metals (e.g. copper, lead) and nutrient uptake in eutrophic areas. Additionally, these macroalgae serve as an important and preferred food source for numerous marine organisms including the grazer Littorina littorea. I explored the relationship between the role of U. lactuca as a bioremediator and as a food source by examining the grazing preferences of L. littorea on Ulva grown under high Cu concentrations and eutrophic conditions.

Ulva grown in seawater with a Cu concentration of 100 μg/L accumulates over 500% of Cu relative to ambient conditions (ambient levels = 7.37 ± 0.77 μg Cu/g DW; 100 μg/L = 43.0 ± 2.18 μg Cu/g DW). When Cu-enriched Ulva was fed to L. littorea, I found a significant (t-test: $t = 3.49$, $P = 0.004$) reduction in herbivory compared with Ulva grown under ambient conditions (Fig. 1). While tissue analysis of L. littorea revealed a higher mean Cu concentration of snails fed with Cu-enriched Ulva compared to ambient levels, this difference was not significant. However, this preference experiment was run only 3 days, and L. littorea likely did not have sufficient exposure time to Cu-enriched Ulva. Future work with longer exposure time may reveal a biomagnification effect.

I compared grazing preference of L. littorea between Ulva collected from a pristine environment and Ulva from a eutrophic area with elevated nutrient levels due to fertilizer runoff from a nearby golf course. Although elemental analysis showed higher nitrogen (N) content in eutrophic Ulva, this did not vary significantly from controls (percent N: eutrophic Ulva = 2.16%, control (pristine) Ulva = 1.99%, $P = 0.170$). However, L. littorea showed a significant preference ($t = 5.57$, $P = 0.00007$) for Ulva from the eutrophic site relative to the control (pristine) population. This suggests an ability by Littorina to discern between ambient and eutrophic Ulva, displaying preference for the nutrient-enriched (likely more nutritious) algae (Fig. 1). These patterns of herbivory by L. littorea on Ulva grown under elevated Cu- and nutrient-enriched conditions reveal how bioremediation by algae affects its grazers, which may subsequently influence coastal food webs, highlighting consequences of pollution and implications for trophic interactions.

SURF 2018-Post SURF Survey

Name	Melanie Regan
Year of Graduation	2021

Are you in a Graduate program?	no
SURF Advisor	Adam Hall, Biological Sciences
Advisor Department	Biological Sciences
SURF Field of Study	Biological Sciences
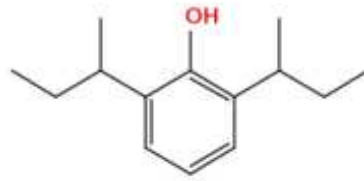
2,6 DSBP mregan.png
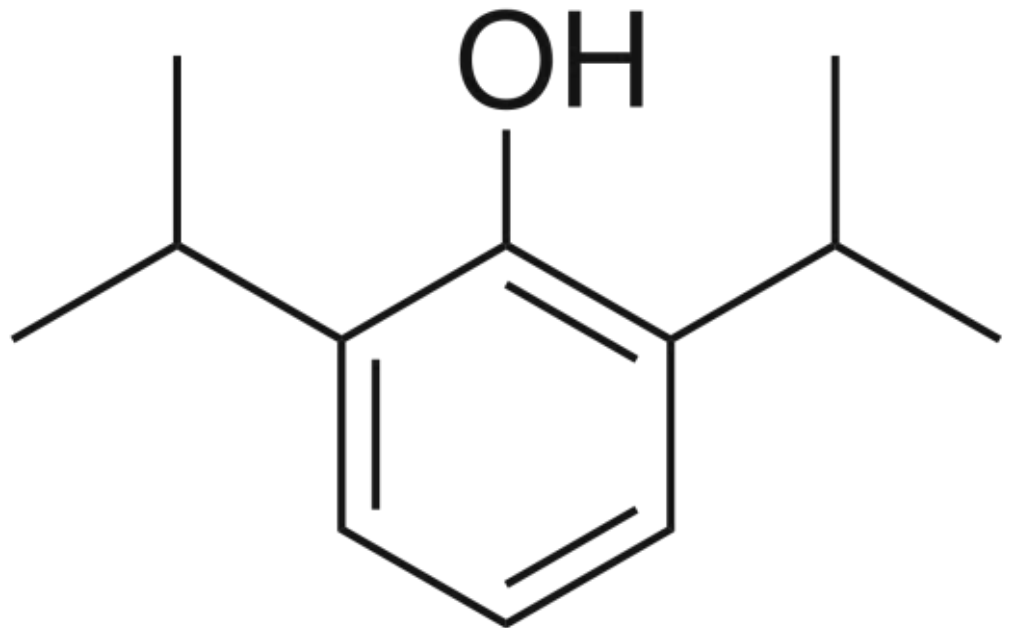
propofol (mregan).png

Title of Abstract/Research   Characterization and Comparison of 2,6 Di-Sec-Butylphenol Modulation on GABAA and Glycine Receptors

Please type your abstract below.

Propofol, a drug administered intravenously to induce sedation during medical procedures proves to be critical for modern medicine as a general anesthetic. For decades propofol has been used as a general anesthetic, but the mechanism in which general anesthetics worked has been unknown until recently. Molecular targets and pathways have been found to be modulated by general anesthetics including the GABAA and glycine receptors which are the focus of my summer experiments. 2,6 Di-Sec-Butylphenol (2,6 DSBP) is an analog of propofol which has sec-butyl substituents at the 2 and 6 positions on phenol instead of propofol's equivalent isopropyl substituents (see Figure 1, and Trapani et al, 1998; Hemmings et al, 2005). 2,6 DSBP has been found to positively modulate GABAA receptor currents more than propofol, making 2,6 DSBP a potential novel anesthetic. For my experiments, GABAA and glycine receptors were expressed in Xenopus Laevis oocytes and then currents were recorded using a two-electrode voltage clamping method. Dose responses of GABA and glycine were recorded at varying concentrations from 3uM to 1mM . This experiment confirmed high potency of 2,6 DSBP for GABAA and glycine receptors modulations, 2,6 DSBP had a greater effect on the GABAA receptors than the glycine receptors.

References:
Hemmings Jr. H.C., Akabas M.H., Goldstein P.A., Trudell J.R., Orser B.A., Harrison N.L. Emerging Molecular Mechanisms of General Anesthetic Action Trends in Pharmacological Sciences. 2005, 26 , 503-510.
Trapani, G.; Latrofa, A.; Franco, M.; Altomare, C.; Sanna, E.; Usala, M.; Biggio, G.; Liso, G. Propofol Analogues. Synthesis, Relationships between Structure and Affinity at GABAA Receptor in Rat Brain, and Differential Electrophysiological Profile at Recombinant Human GABAA Receptors. Journal of Medicinal Chemistry 1998 41 (11), 1846-1854

Figure 1: 2,6 Di-Sec-Butylphenol (2,6 DSBP) chemical structure in comparison to propofol (2,6 Diisopropylphenol) chemical structure.

SURF 2018-Post SURF Survey

Name	Ava Friedlander **Smith**
Year of Graduation	2020

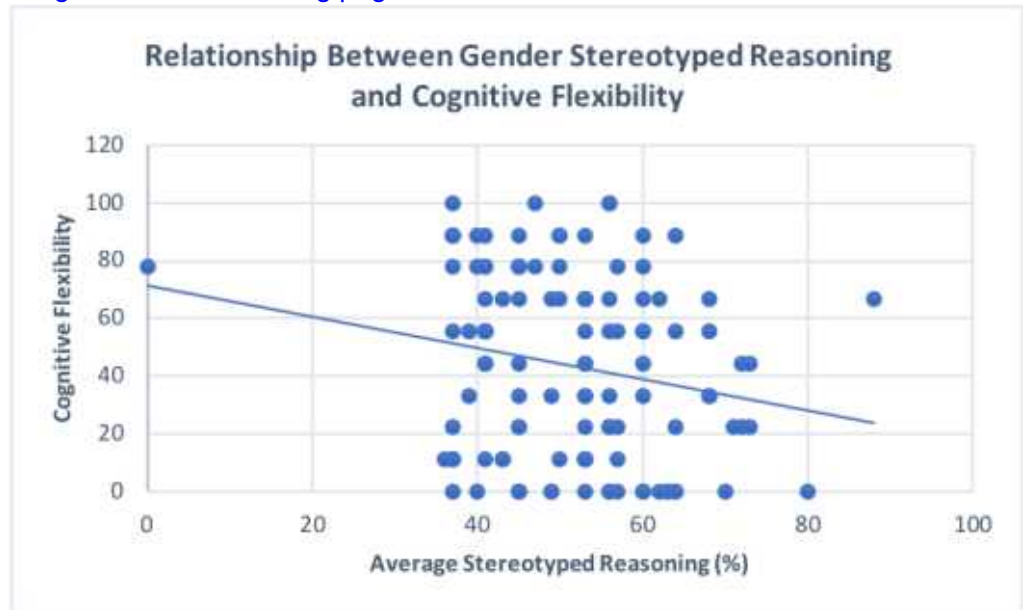|	
Are you in a Graduate program?	no
SURF Advisor	Maryjane Wraga, Psychology
Secondary SURF Advisor	Jennifer McDermott
Advisor Department	Psychology
SURF Field of Study	Psychology
Please list co-authors of your abstract	June Wai Lee, Deborah Wu, Jennifer McDermott

Upload image(s) in .png format; 1,100 MB max size each

Relationship Between Judgement and Gender Stereotyped Reasoning

JudgementandReasoning.png

Relationship Between Gender Stereotyped Reasoning and Cognitive Flexibility
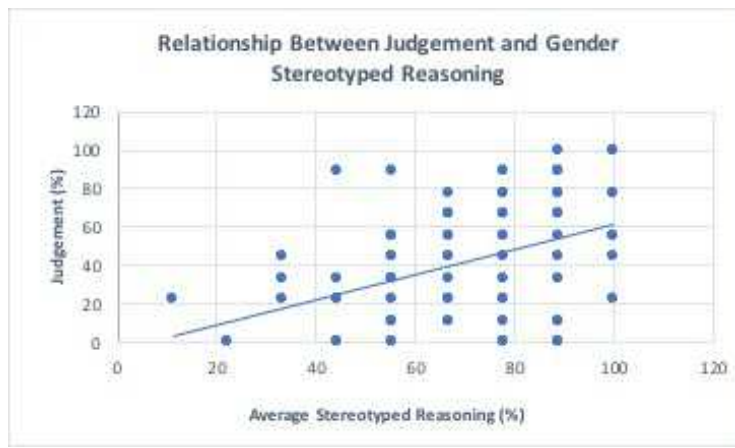
ReasoningandCF.png

Title of Abstract/Research

"Girls Don't Ride Firetrucks": Development of Executive Function and Gender Stereotype Reasoning in Middle Childhood

Please type your abstract below.

Gender stereotypes form early through a range of experiences, including observations or even exposure to toys (Allport, 1954; Gutwald, 2017). Although research has shown that children hold stereotypes (Gettys & Cann, 1981), little is known about how cognitive processes, like executive functioning (EF), contribute to stereotyped thinking across childhood. In particular, the EF skill, cognitive flexibility, which allows children to interpret information across dimensions (Anderson, 2002), may be a key in assisting children to reduce their stereotyped thought. Therefore, the goal of the current study was to examine if cognitive flexibility in middle childhood is associated with lower rates of stereotypical thinking. Participants were 118 children, (88 females, Mage = 7.11, SD = 0.83) that took part in a larger project assessing gender stereotypes. Participants were shown pictures depicting a man and woman dressed in a range of occupations that are societally associated with one gender and asked: "Which one is the (occupation): the man or the woman?". They were then asked to explain their choice. Justification of their choice was used as the indicator of stereotypical reasoning, and two independent coders ($κ$'s > .86) scored responses on a dichotomous scale (0: non-gender-related reasoning; 1: gender-related reasoning). Responses were averaged across professions to create two composite scores: judgement and reasoning. Parents completed the Behavioral Rating Inventory of Executive Function to assess children's cognitive flexibility via the SHIFT scale. Lower scores denoted greater cognitive flexibility. Children chose the gender that was stereotypically associated with each career, 71.85% (SD = 18.76) of the time. As anticipated, there was a significant association between judgement and stereotypical reasoning (B = 0.65, SEB = 0.15, p < .001), such that participants who made stereotypical choices also gave stereotypical justification for their choice. Contrary to our hypotheses, higher levels of cognitive flexibility corresponded to greater stereotypical reasoning (B = -0.54, SEB = 0.25, p = .031). After controlling for age, gender, and condition, these results remained stable. These results highlight the high rate of stereotyped judgements about career paths during middle childhood and indicate that EF skills may contribute to stronger stereotypical thinking. Increased EF may not be enough to break perceptions and suggest that additional factors, like non-stereotyped experiences may be important in influencing perceptions. Overall, these findings reveal complex associations between cognitive processes and the development of stereotyped reasoning and suggest novel directions for interventions to reduce gender stereotyped thinking in childhood.

SURF 2018-Post SURF Survey

Name	Renee Halloran
Year of Graduation	2018

Are you in a Graduate program?	yes
SURF Advisor	Marney Pratt, Biological Sciences
Advisor Department	Biological Sciences
SURF Field of Study	Mill River Survey
Please list co-authors of your abstract	Lyric Williams, Sasha Clapp
Upload image(s) in .png format; 1,100 MB max size each	SURF 2018 abstract graph.png
Title of Abstract/Research	The Fourth Year of the Paradise Pond Project: Macroinvertebrates as Bioindicators of River Health
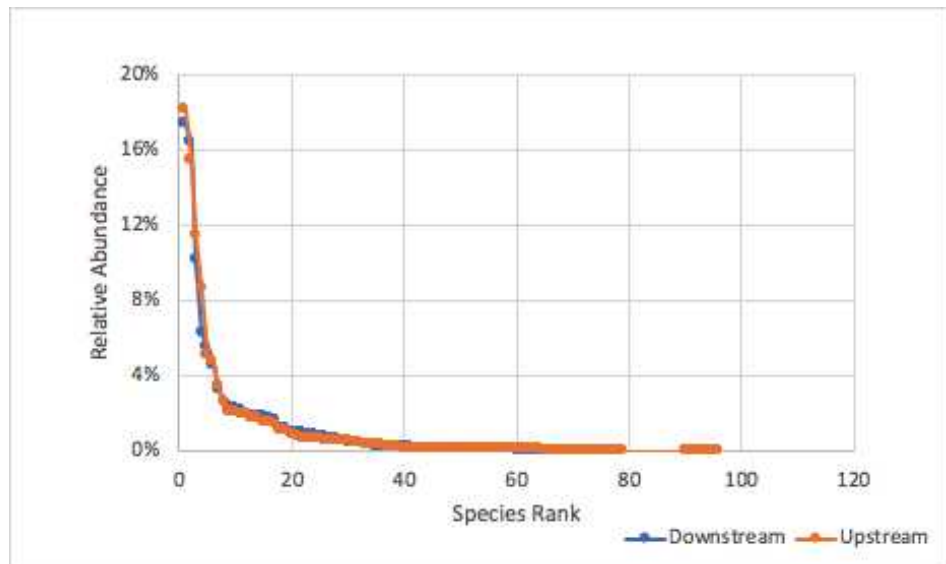
Please type your abstract below.

Paradise Pond, a treasured landmark and a valued recreational and educational resource of the Smith College Community, is an impoundment created by a dam on the Mill River (Sinton 2002). Because dams fundamentally disrupt the movement of water, and therefore movement of sediment, Smith College has implemented a sediment management protocol to prevent Paradise Pond from completely filling with the inevitably accumulating deposition (Wells et al. 2007). Although managing sediment is innately disruptive to the surrounding environment, it is necessary to maintain the existence of the pond. In an attempt to minimize the ecological consequences of sediment redistribution in the pond, state regulations require Smith College to monitor the ecological impact that sediment management has on the Mill River and to assess the best method of managing the sediment long-term. The Paradise Pond Sediment Management Project can therefore best be described as a continual assessment of the balance between preserving the iconic Paradise Pond and ensuring the ecological health of the Mill River while doing so.

To assess Smith College's impact on the Mill River, the Before-After-Control-Impact (BACI) design was utilized to compare diversity indices of macroinvertebrates upriver (control) and downriver (impact) of Paradise Pond before and after the July 2016 sediment redistribution (Strayer & Smith 2003). The relative ease with which freshwater invertebrates can be surveyed make them ideal systems to assess how Smith College's sediment management in Paradise Pond might influence the river. Aquatic macroinvertebrates function as an indication of stream health because many are intolerant of environmental variability. Comparisons of macroinvertebrate communities in upriver and downriver sites can illuminate whether or not sediment redistribution in July 2016 has had any impacts on the river 2 years later. Using kicknet sampling, macroinvertebrates were collected during June 2018 at upriver and downriver riffle sites, and then identified to the lowest level feasible (usually the genus level).

A healthier river is typically more diverse. One of the ways to assess river diversity is to compare species rank abundance curves from both sites using a pairwise Kolmogorov-Smirnov test. Organisms were ranked from most to least abundant and relative abundances were calculated. In June 2016, before sediment redistribution, the downriver site was significantly more diverse than the upriver site (d-stat = 0.1112, d-crit= 0.0735, p=0.0004). One year after sediment redistribution, in summer 2017, the upriver site was significantly more diverse than the downriver site (d-stat= 0.0968, d-crit= 0.0737, p=0.003), suggesting that sediment redistribution had an impact on the downriver site. However, in summer 2018, there was no significant difference in diversity between the two locations, (Figure 1: d-stat = 0.0359, d-crit = 0.0476, p=0.24). These results suggest that two years after sediment redistribution in Paradise Pond, macroinvertebrate communities are recovering from the impact of redistribution.

Figure 1. Species Rank Abundance Curve for the macroinvertebrate data collected in June 2018 from the Mill River in Northampton, MA. Species rank was determined by ranking organisms from most to least abundant where a rank of 1 represents the most abundant. Most organisms were identified to the genus level, but for this analysis all worms were lumped together at the class level, and all midges were lumped together at the family level. Relative abundance was calculated as the number of a particular organism divided by all organisms found at the same location times 100. Points in blue represent the organisms found downstream of Paradise Pond, while points in orange are those found upstream of the pond.

Literature Cited:

Sinton, J. 2002, April. A Short History of the Mill River Watershed 1650-1940.

Strayer, D. L., and D. R. Smith. 2003. A guide to sampling freshwater mussel populations. American Fisheries Society, Monograph 8, Bethesda, Maryland.

Wells, R. R., E. J. Langendoen, and A. Simon. 2007. Modeling Pre- and Post-Dam Removal Sediment Dynamics: The Kalamazoo River, Michigan1. JAWRA Journal of the American Water Resources Association 43:773–785.

SURF 2018-Post SURF Survey

Name	Lyric Williams
Year of Graduation	2019
Are you in a Graduate program?	no
SURF Advisor	Marney Pratt, Biological Sciences
Advisor Department	Biological Sciences
SURF Field of Study	Biology
Please list co-authors of your abstract	Sasha Clapp, Renee Halloran
Upload image(s) in .png format; 1,100 MB max size each	LWilliams.png
Title of Abstract/Research	The Fourth Year of the Paradise Pond Project: Macroinvertebrates as Bioindicators of River Health
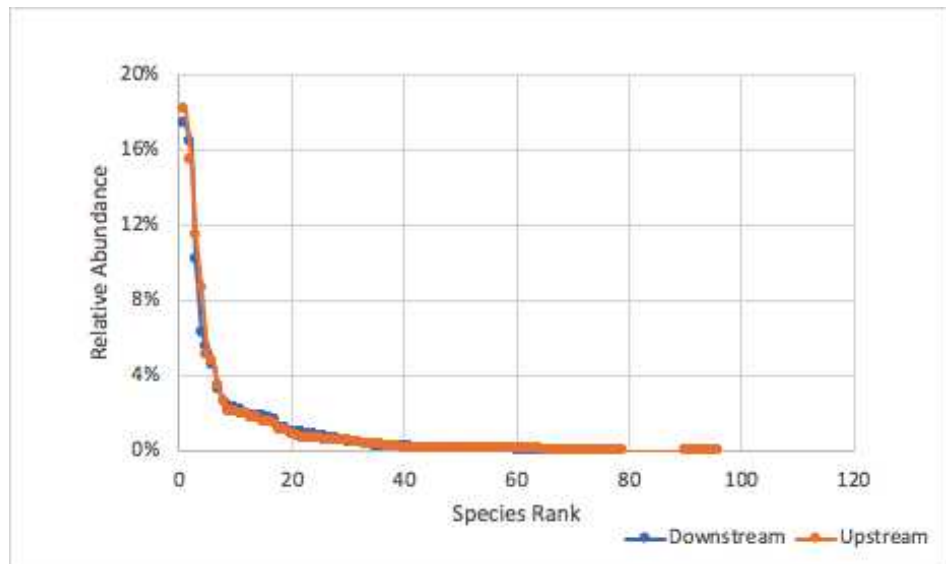
Please type your abstract below.

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Strayer, D. L., and D. R. Smith. 2003. A guide to sampling freshwater mussel populations. American Fisheries Society, Monograph 8, Bethesda, Maryland.

Wells, R. R., E. J. Langendoen, and A. Simon. 2007. Modeling Pre- and Post-Dam Removal Sediment Dynamics: The Kalamazoo River, Michigan1. JAWRA Journal of the American Water Resources Association 43:773–785.

Name	Ursula Miguel
Year of Graduation	2020
Are you in a Graduate program?	no
SURF Advisor	Bosiljka Glumac, Geosciences
Secondary SURF Advisor	H. Allen Curran
Advisor Department	Geosciences
SURF Field of Study	Geosciences
Please list co-authors of your abstract	Adrianna Grow '20J, Jessie Hinners '21, Lexie Leeser '21, Kristine Lu '21, Maria Mutka '21, Em Papineau '21, and Ibuki Sugiura '21
Upload image(s) in .png format; 1,100 MB max size each	UMiguel_BreachingOfRedPond.png
Title of Abstract/Research	Using Google Earth Historical Images to Assess Impact of Hurricanes in the Bahamas

Please type your abstract below.

Historical satellite imagery is related to information about intensity and pathways of hurricanes in the Bahamas to assess amount and style of modifications by major storms during this time of globally rising sea level. Examples include severe beach erosion, damage to roads, washovers of beach sand and rock boulders into interior settings, and conversion of coastal lakes to lagoons with creation of new inlets (Figure 1). This work specifically evaluates the usefulness of Google Earth historical imagery for documenting hurricane impact.

Google Earth historical imagery has been available since about 2001, with variable coverage throughout the Bahamas. Seven major hurricanes (i.e., sustained winds > 111 mph or Category 3 and higher on the Saffir-Simpson scale) impacted the Bahamas during this time: Frances (2004), Ike (2008), Irene (2011), Sandy (2012), Joaquin (2015), Matthew (2016), and Irma (2017). Google Earth imagery of all islands impacted by these hurricanes was examined, and some of the most impressive examples from hurricanes Ike, Joaquin, Matthew, and Irma on San Salvador and Great Inagua islands are documented and supplemented by field photos and high-resolution drone images.

Google Earth proved to be a useful tool for such documentation, but the variable timing of image acquisition is not ideal for recording hurricane impact before natural and human-assisted recovery processes begin. Google Earth images also have limited resolution compared to high-resolution drone images, which are particularly useful, but can be difficult and expensive to acquire. Generating drone images also is dependent upon the ability to travel to impacted areas in a timely manner after major storms. Google Earth was especially useful for historical documentation of examples of storm impact that were previously identified in the field, but it was generally challenging to locate new examples, which could potentially be examined on site in the future. Overall, this methodology and results represent an important means for documenting and communicating information about vulnerability to hurricanes with local residents, developers, and other decision- and policy-makers in the Bahamas. With co-authors Adrianna Grow '20J, Jessie Hinners '21, Lexie Leeser '21, Kristine Lu '21, Maria Mutka '21, Em Papineau '21, and Ibuki Sugiura '21, this work will be presented at the Geological Society of America Annual Meeting in Indianapolis in November 2018.

Figure 1: Breaching of Red Pond on north coast of Great Inagua Island, Bahamas, by hurricane Ike (2008). Before (2003; left) and after (2012; right) images showing breaching of the road and subsequent creation of a coastal lagoon with a tidal inlet and sand spits.

SURF 2018-Post SURF Survey

Name	Aidan Coffin Ness
Year of Graduation	2020
Are you in a Graduate program?	no
SURF Advisor	L.David Smith, Biological Sciences
Secondary SURF Advisor	Denise Lello
Advisor Department	Biological Sciences
SURF Field of Study	Biological Sciences
Please list co-authors of your abstract	Dana Vera, Emiline Koopman, Liz Nagy, Katherine Akey, Carla Schwartz
Title of Abstract/Research	Coral Reef Ed-Ventures Summer 2018

Please type your abstract below.

Summer 2018 was the nineteenth year of the Smith College collaboration with Hol Chan Marine Reserve on Ambergris Caye, Belize to create an environmental education and conservation experience for the children of San Pedro. Six Smith students developed the theme of "Making Connections" in the two free camps they designed for children on the island, incorporating methods they practiced during a week of research on the island with Smith College professors prior to the camps. The research focused on coral mounds at Mexico Rocks and mangroves propagules located in lagoons near the Grand Belizean Estates development.

Smith students conducted two research projects with professors David Smith, Denise Lello and Allen Curran. The first project was part of a long term survey of the health of coral mounds inside the barrier reef at a site called Mexico Rocks that was recently accorded protection as part of the Hol Chan Marine Reserve. These long term surveys at Mexico Rocks are meant to assess the amount of live coral cover and soft coral abundance and diversity, and track significant changes over time. Previously, several mounds towards the center of Mexico Rocks and several towards the south end had been sampled. These were resampled this year along with several mounds at the north end of the area. The second project tracked mangrove survival in the mangrove lagoons in the interior of the island in the vicinity of fill associated with development. Previous research has indicated that several biotic and abiotic factors can impact the persistence of mangrove. Students mapped all propagules within plots and collected data for each propagule mapped using underwater images of organisms associated with the propagules and visual assessment of damage and herbivory.

This year's theme for youth camp, the first summer camp that the Smith students hosted, was "Making Connections". The Smith students created activities focused on five topics: human impact, plastics, mangroves, fossil fuels, and marine protected areas (MPAs). For example, the campers were presented with information about how macro and micro-plastics affect the entire food chain, starting with bottom of the food chain and moving up to large fish which humans may eventually consume. Interactive activities (e.g., a beach clean up, an edible coral polyp activity) were paired with short lectures and videos. This versatility allowed campers to make connections between the ocean ecosystems and inhabitants and land-based human activities, and gain more perspective and awareness about how they can best protect our oceans.

Children 12 and up, or those who had previously participated in the Youth Camp, attended an upper level R.E.E.F (Research in Ecology and the Environment is Fun) Program. This year's theme for the R.E.E.F. program was "Mapping". Campers were introduced to various spatial research methods, including how to calculate percent live coral cover on coral mounds. Environmental consultants, who were performing assessments prior to development of the the neighboring island of Blackadore Caye, came to camp, discussed techniques for mapping the seafloor around Ambergris Caye, and showed campers the advanced equipment they use. Campers also collected and mapped the plastics they found on the beach in front of the high school, using GPS and data collection software the Smith students had used in the mangrove research. Campers took two field trips, one to the mangroves and one to the lagoon side of the island. During the field trip to the mangroves, children learned about the importance of the mangroves and how crocodiles are rehabilitated and released in the area. With a greater understanding of how research is conducted, campers were able to make meaningful connections between the ecosystems that link the ocean and their home on the island of Ambergris Caye.

In summary, our research advanced understanding of changes in coral and mangrove habitats and the education program exposed children on the island to specific environmental changes that are impacting their everyday life (e.g., plastics). This summer of Coral Reef Ed-Ventures was full of new experiences and learning opportunities that we hope to expand upon in coming years.

SURF 2018-Post SURF Survey

Name	Katherine Fairbank
Year of Graduation	2021

Are you in a Graduate program?	no
SURF Advisor	Susan Voss, Engineering
Advisor Department	Engineering
SURF Field of Study	Engineering and Auditory Science
Please list co-authors of your abstract	Lauren Tinglin
Upload image(s) in .png format; 1,100 MB max size each	

3D Canal Model.png

Title of Abstract/Research	Analyzing the Cross-Sectional Area of the Middle Ear using 3D Models

Please type your abstract below.

Noninvasive auditory tests do not exist for some hearing problems. Wideband acoustic immittance (WAI) serves to combat this issue as it is very likely to detect middle-ear problems with basic testing, but some require knowledge of the ear's cross sectional area. Recent work in the Voss lab has found that the cross-sectional area assumed by these diagnostic tools, 44mm², was an inaccurate assumption depending on the age of patients. One of the lab's goals is to create a normative database of WAI measurements across different ages and sexes to account for the variation in canal area.

This summer, our research aimed to add ear-canal areas to the normative database of WAI measurements by measuring areas from canal molds as well as working with UMASS Medical to access over fifty CT scans of the ear canal. Our major goals were to strengthen the methodology used to measure ear canal molds of approximately one hundred patients ranging from their 20's to 60's as well as creating procedures to construct and measure the cross sectional area of the ear canal from CT scans.
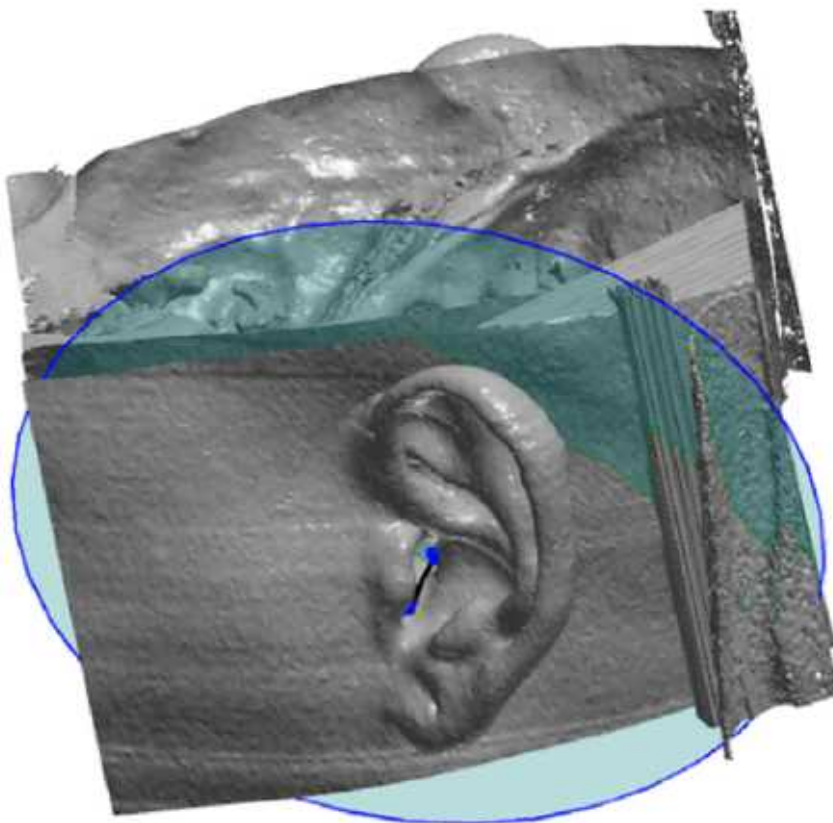
To meet these goals we used several programs such as 3DSlicer, which was most effective for the 3D reconstruction of the ear canal from the CT scans. The program allowed for efficient isolation of the canals as well as high quality resolution. With this program, a procedure was created to convert the DICOM files received from UMASS Medical into the necessary models. Once the models were constructed, they were exported to 3Shape Shape Designer, and cross sectional measurements were made at the 12mm landmark, which prior research concluded that it had the same area as the first bend. By comparing the cross-sectional area of said molds and models, it was found that area often increases by age; the average patient exhibited ears larger than the standard 44mm².

The next step of this project will be to verify the methodology by performing measurements on the CT scans and ear canal molds of the same people. This will ensure that measuring the cross-sectional from the CT scans or the molds will yield the same results; therefore validating both processes as ways to determine cross-sectional area.

SURF 2018-Post SURF Survey

Submission Date	2018-07-26 11:02:08
Name	Lauren Tinglin
Smith ID#	991213563
Year of Graduation	2019
Smith E-mail	ltinglin@smith.edu
Are you a January graduate?	no
Are you an Ada Comstock scholar?	no
Are you in a Graduate program?	no
SURF Advisor	Susan Voss, Engineering
Advisor Department	Engineering
SURF Field of Study	Engineering
Please list co-authors of your abstract	Katie Fairbank
Upload image(s) in .png format; 1,100 MB max size each	

3D Canal Model.png

Title of Abstract/Research	Analyzing the Cross-Sectional Area of the Middle Ear using 3D Models
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SURF 2018-Post SURF Survey

Name	Emiline Koopman
Year of Graduation	2018

Are you in a Graduate program?	no
SURF Advisor	L.David Smith, Biological Sciences
Advisor Department	Biological Sciences
SURF Field of Study	Biology
Please list co-authors of your abstract	Dana Vera, Liz Nagy, Carla Shwartz, Katherine Akey, Aidan Coffin Ness
Title of Abstract/Research	Coral Reef Ed-Ventures Summer 2018

Please type your abstract below.

Coral Reef Ed-Ventures Summer 2018

Emiline Koopman '18J, Dana Vera '19, Liz Nagy '18, Aidan Coffin Ness '20,
Katherine Akey '20, Carla Schwartz '20

Summer 2018 was the nineteenth year of the Smith College collaboration with Hol Chan Marine Reserve on Ambergris Caye, Belize to create an environmental education and conservation experience for the children of San Pedro. Six Smith students developed the theme of "Making Connections" in the two free camps they designed for children on the island, incorporating methods they practiced during a week of research on the island with Smith College professors prior to the camps. The research focused on coral mounds at Mexico Rocks and mangroves propagules located in lagoons near the Grand Belizean Estates development.

Smith students conducted two research projects with professors David Smith, Denise Lello and Allen Curran. The first project was part of a long term survey of the health of coral mounds inside the barrier reef at a site called Mexico Rocks that was recently accorded protection as part of the Hol Chan Marine Reserve. These long term surveys at Mexico Rocks are meant to assess the amount of live coral cover and soft coral abundance and diversity, and track significant changes over time. Previously, several mounds towards the center of Mexico Rocks and several towards the south end had been sampled. These were resampled this year along with several mounds at the north end of the area. The second project tracked mangrove survival in the mangrove lagoons in the interior of the island in the vicinity of fill associated with development. Previous research has indicated that several biotic and abiotic factors can impact the persistence of mangrove. Students mapped all propagules within plots and collected data for each propagule mapped using underwater images of organisms associated with the propagules and visual assessment of damage and herbivory.

Figure 1 - Liz and Katherine taking quadrat pictures of a mound in Mexico Rocks during research week.

Figure 2 - Katherine and Aidan filling out a mangrove propagule survey during research week.

This year's theme for youth camp, the first summer camp that the Smith students hosted, was "Making Connections". The Smith students created activities focused on five topics: human impact, plastics, mangroves, fossil fuels, and marine protected areas (MPAs). For example, the campers were presented with information about how macro and micro-plastics affect the entire food chain, starting with bottom of the food chain and moving up to large fish which humans may eventually consume. Interactive activities (e.g., a beach clean up, an edible coral polyp activity) were paired with short lectures and videos. This versatility allowed campers to make connections between the ocean ecosystems and inhabitants and land-based human activities, and gain more perspective and awareness about how they can best protect our oceans.

Children 12 and up, or those who had previously participated in the Youth Camp, attended an upper level R.E.E.F (Research in Ecology and the Environment is Fun) Program. This year's theme for the R.E.E.F. program was "Mapping". Campers were introduced to various spatial research methods, including how to calculate percent live coral cover on coral mounds. Environmental consultants, who were performing assessments prior to development of the the neighboring island of Blackadore Caye, came to camp, discussed techniques for mapping the seafloor around Ambergris Caye, and showed campers the advanced equipment they use. Campers also collected and mapped the plastics they found on the beach in front of the high school, using GPS and data collection software the Smith students had used in the mangrove research. Campers took two field trips, one to the mangroves and one to the lagoon side of the island. During the field trip to the mangroves, children learned about the importance of the mangroves and how crocodiles are rehabilitated and released in the area. With a greater understanding of how research is conducted, campers were able to make meaningful connections between the ecosystems that link the ocean and their home on the island of Ambergris Caye.

Figure 3 - Youth Camp students working on the "Save the Turtles" mural.

Figure 4 - REEF Program students with the Blackadore team after their visit.

In summary, our research advanced understanding of changes in coral and mangrove habitats and the education program exposed children on the island to specific environmental changes that are impacting their everyday life (e.g., plastics). This summer of Coral Reef Ed-Ventures was full of new experiences and learning opportunities that we hope to expand upon in coming years.

SURF 2018-Post SURF Survey

Name	Carla Schwartz
Year of Graduation	2020

Are you in a Graduate program?	no
SURF Advisor	Denise Lello, Biological Sciences
Advisor Department	Biological Sciences
SURF Field of Study	Biology
Please list co-authors of your abstract	Emiline Koopman '18J, Dana Vera '19, Liz Nagy '18, Aidan Coffin Ness '20, Katherine Akey '20
Title of Abstract/Research	Coral Reef Ed-Ventures Summer 2018

Please type your abstract below.

Summer 2018 was the nineteenth year of the Smith College collaboration with Hol Chan Marine Reserve on Ambergris Caye, Belize to create an environmental education and conservation experience for the children of San Pedro. Six Smith students developed the theme of "Making Connections" in the two free camps they designed for children on the island, incorporating methods they practiced during a week of research on the island with Smith College professors prior to the camps. The research focused on both coral mounds at Mexico Rocks and the mangroves (propagules) located across Island Road in the new development Grand Belizean Estates.

Smith students conducted two research projects with professors David Smith, Denise Lello and Allen Curran. The first project was part of a long term survey of the health of coral mounds inside the barrier reef at a place called Mexico Rocks that was recently accorded protection as part of the Hol Chan Marine Reserve. These long term surveys at Mexico Rocks are meant to assess the amount of live coral cover and soft coral abundance, and track significant changes over time. Previously, several mounds towards the center of Mexico Rocks and several towards the south end had been sampled. These were resampled this year along with several mounds at the north end of the area. The second project tracked mangrove survival in the mangrove lagoons in the interior of the island in the vicinity of fill associated with development. Previous research has indicated that several biotic and abiotic factors can impact the persistence of mangrove. Students mapped all propagules within plots and collected data for each propagule mapped, using underwater images of organisms associated with the propagules and visual assessment of damage and herbivory.

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SURF 2018-Post SURF Survey

Name	QIYI QIAN
Year of Graduation	2020
Are you in a Graduate program?	no
SURF Advisor	David Bickar, Chemistry
Advisor Department	Biochemistry
SURF Field of Study	Biochemistry and Neuroscience
Upload image(s) in .png format; 1,100 MB max size each	
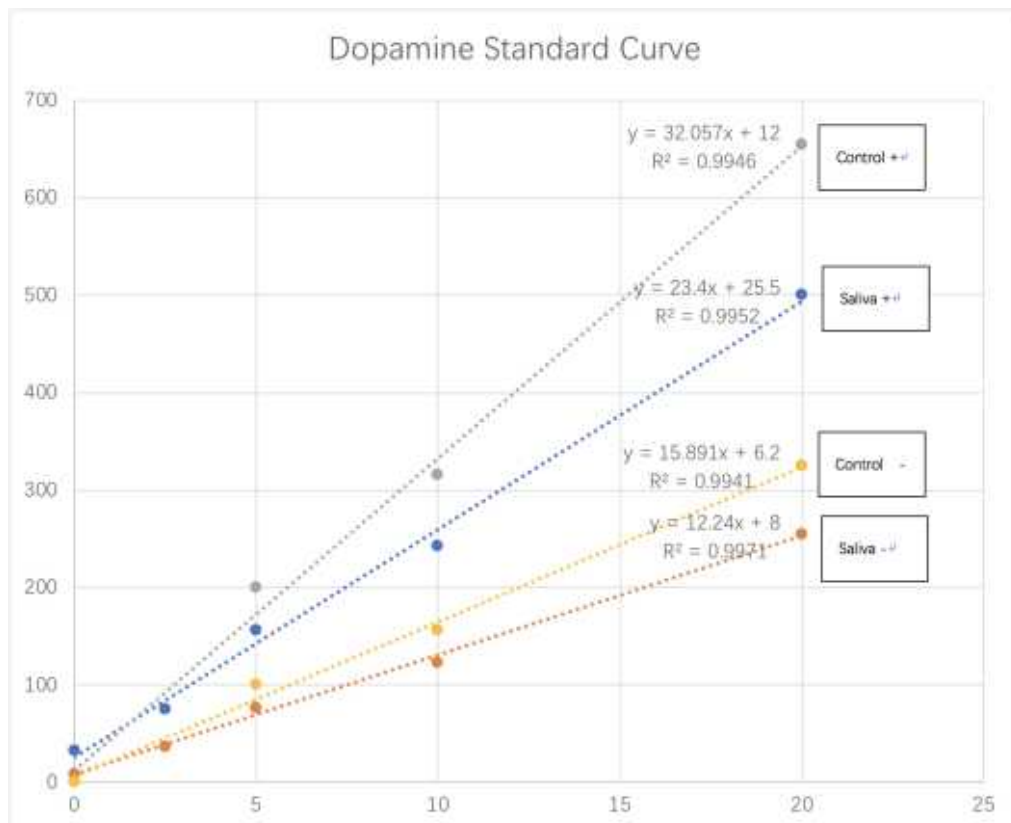
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Title of Abstract/Research	Salivary Dopamine Levels

Please type your abstract below.

Diagnosing Parkinson's disease early and accurately is essential for effective medical intervention. The pathological symptoms of Parkinson's disease are caused by the loss of dopaminergic neurons in the substantia nigra. We believe that before the loss of these neurons occurs, dopaminergic neurons in the "enteric nervous system" (neurons associated with the digestive tract) are destroyed. If so, changes in the dopamine levels in enteric fluids, such as saliva, could provide an early biomarker for the diagnosis of Parkinson's disease.

To determine salivary dopamine levels, we first collect saliva using an oral swab placed under the tongue. The dopamine is then removed from the saliva chromatographically and quantified using high performance liquid chromatography with electrochemical detection. However, dopamine is unstable in saliva, and its concentration decreases over time. We found that we could improve the rate of saliva production by sucking on candy lozenges containing citric or ascorbic acid, which helped preserve the salivary dopamine. A further improvement was to add "protectants," compounds that stabilize dopamine in saliva, immediately after saliva collection. This decreased the rate of dopamine loss during the purification. We found that an acidic solution containing EDTA was reasonably effective as a protectant.

Proteins in human saliva can make the liquid so viscous that it obstructed our purification procedures. In order to remove the salivary proteins, we tested several methods, including changes in temperature, centrifugation and the addition different organic solvents, and identified a procedure that minimized their effects.

To confirm the consistency and reliability of our assay, we prepared a standard curve using saliva samples containing added dopamine and measured their dopamine concentrations using our assay. The results showed the assay response to be proportional to the dopamine concentration, and when plotted gave an R^2 value of >0.99.

To test for a circadian rhythm in salivary dopamine production, we looked at the salivary dopamine concentrations at different times during the day. We extracted saliva samples hourly and compared the salivary dopamine concentration at different times to see if a specific pattern of changes in human salivary catecholamine levels could be observed. Although dramatic differences in salivary dopamine concentrations were observed in samples collected at different times, the levels did not show an obvious pattern. We are still in the process of obtaining more data to see if any periodicity, circadian or otherwise, in the pattern of salivary dopamine concentration can be observed.

SURF 2018-Post SURF Survey

Name	Emily Akey
Year of Graduation	2020

Are you in a Graduate program?	no
SURF Advisor	L.David Smith, Biological Sciences
Secondary SURF Advisor	Denise Lello
Advisor Department	Biological Sciences
SURF Field of Study	Biology
Please list co-authors of your abstract	Emiline Koopman '18J, Dana Vera '19, Liz Nagy '18, Aidan Coffin Ness '20, Carla Schwartz '20
Title of Abstract/Research	Coral Reef Ed-Ventures Summer 2018

Please type your abstract below.

Summer 2018 was the nineteenth year of the Smith College collaboration with Hol Chan Marine Reserve on Ambergris Caye, Belize to create an environmental education and conservation experience for the children of San Pedro. Six Smith students developed the theme of "Making Connections" in the two free camps they designed for children on the island, incorporating methods they practiced during a week of research on the island with Smith College professors prior to the camps. The research focused on both coral mounds at Mexico Rocks and the mangroves (propagules) located across Island Road in the new development Grand Belizean Estates.

Smith students conducted two research projects with professors David Smith, Denise Lello and Allen Curran. The first project was part of a long term survey of the health of coral mounds inside the barrier reef at a place called Mexico Rocks that was recently accorded protection as part of the Hol Chan Marine Reserve. These long term surveys at Mexico Rocks are meant to assess the amount of live coral cover and soft coral abundance, and track significant changes over time. Previously, several mounds towards the center of Mexico Rocks and several towards the south end had been sampled. These were resampled this year along with several mounds at the north end of the area. The second project tracked mangrove survival in the mangrove lagoons in the interior of the island in the vicinity of fill associated with development. Previous research has indicated that several biotic and abiotic factors can impact the persistence of mangrove. Students mapped all propagules within plots and collected data for each propagule mapped, using underwater images of organisms associated with the propagules and visual assessment of damage and herbivory.

This year's theme for youth camp, the first summer camp that the Smith students hosted, was "Making Connections". The Smith students created activities focused on five topics: human impact, plastics, mangroves, fossil fuels, and marine protected areas (MPAs). For example, the campers were presented with information about how macro and micro-plastics affect the entire food chain, starting with bottom of the food chain and moving up to large fish which humans may eventually consume. Interactive activities (e.g., a beach clean up, an edible coral polyp activity) were paired with short lectures and videos. This versatility allowed campers to make connections between the ocean and land-based human activities, and gain more perspective and awareness about how they can best protect our oceans.

Children 12 and up, or those who had previously participated in the Youth Camp attended an upper level R.E.E.F (Research in Ecology and the Environment is Fun) Program. This year's theme for the R.E.E.F. program was "Mapping". Campers were introduced to various spatial research methods, including how to calculate percent live coral cover on coral mounds. Environmental consultants, who were performing assessments prior to development of the the neighboring island of Blackadore Caye, came to camp, discussed techniques for mapping the seafloor around Ambergris Caye, and showed campers the advanced equipment they use! Campers also collected and mapped the plastics they found on the beach in front of the high school, using GPS and data collection software the Smith students had used in the mangrove research. Campers took two field trips, one to the mangroves and one to the lagoon side of the island. During the field trip to the mangroves, children learned about the importance of the mangroves and how crocodiles are rehabilitated and released in the area. With a greater understanding of how research is conducted, campers were able to make meaningful connections between the ecosystems that link the ocean and their home on the island of Ambergris Caye.

Research advanced understanding of changes in coral and mangrove habitats and the education program exposed children on the island to specific environmental changes that are impacting their everyday life (e.g., plastics). This summer of Coral Reef Ed-Ventures was full of new experiences and learning opportunities that we hope to expand upon in coming years.

SURF 2018-Post SURF Survey

Name	Abigail Beckham
Year of Graduation	2019

Are you in a Graduate program?	no
SURF Advisor	Bosiljka Glumac, Geosciences
Secondary SURF Advisor	H. Allen Curran
Advisor Department	Geosciences
SURF Field of Study	Geosciences
Upload image(s) in .png format; 1,100 MB max size each
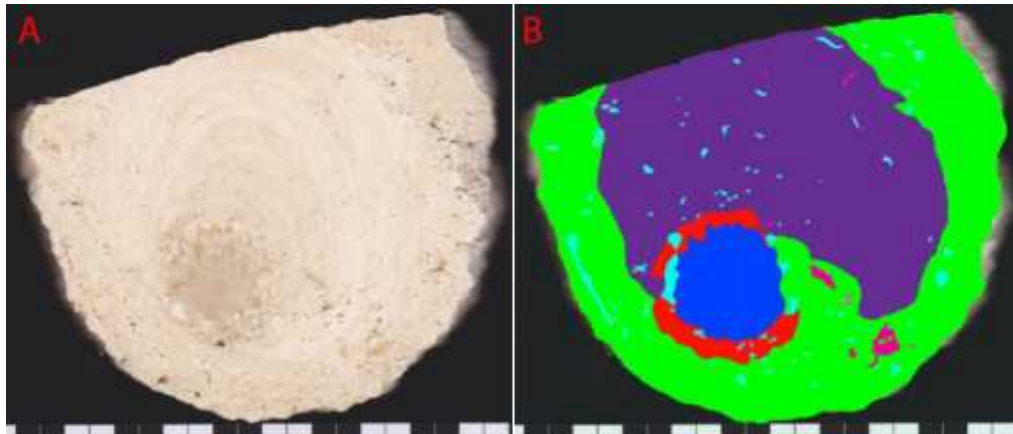
Abigail Beckham Figure 1.png |
| **Title of Abstract/Research** | Encrusters on Corals from Pleistocene Reefs in The Bahamas: Examples from San Salvador and Great Inagua |

Please type your abstract below.	Outcrops of Pleistocene coral reef deposits of the Cockburn Town Member (Grotto Beach Formation; Eemian; MIS 5e) on San Salvador and Great Inagua Islands in the Bahamas provide an important source of information about paleoenvironmental conditions and sea-level fluctuations during the last interglacial highstand. This research builds upon our previous field and petrographic work from two sites on San Salvador, aimed at analyzing in detail the abundance, distribution and succession of various types of encrusters on corals, with the addition of two locations on Great Inagua. Stable isotope analysis was also conducted to provide insights into the depositional and diagenetic history of these deposits.

Cockburn Town Fossil Reef on the west coast of San Salvador has in situ reef exposures ~3 m above modern sea-level, that are separated by an erosional discontinuity into Reef I and II deposits (RI & RII). RI contains branching corals encrusted by red crustose coralline (RCC) algae, foraminifera, serpulids, stromatolites, and clotted microbialites (Figure 1), while RII corals lack thick encrustations. The same unconformity separates RI and RII deposits at Devil's Point on the west coast of Great Inagua. However, corals in RI exhibit only typical taphonomic modification with very thin encrustations, but an in situ RII exposure of Acropora palmata corals has a crust up to 2 cm thick, forming an encrusted branching-coral framework with irregular, bumpy exterior. Our Matthew Town Marina site, also on the west coast of Great Inagua, is a spoil pile of boulders, likely from RI, containing Orbicella annularis corals with encrustations similar to those on San Salvador.

Transition from coral to encrusting RCC algae to microbialites in RI on San Salvador has been interpreted as a change in reef development from bank barrier to restricted backreef and lagoonal environments. The absence of thick encrusters in RI at Devil's Point on Great Inagua and the encrusted branching framework in the lower part of RII illustrate important differences between Pleistocene coral reefs on San Salvador and Great Inagua. The presence of microbialites on displaced Marina boulders on Great Inagua, however, reveals some similarities with microbial encrusters from San Salvador. Stable isotope results further illustrate these important similarities and differences. With co-authors Agnese Mannucci (University of Florence, Italy) and David Griffing (Hartwick College), this work will be presented at the Geological Society of America Annual Meeting in Indianapolis in November 2018.

(Supported by the Schulz Foundation)
Advisors: Bosiljka Glumac and H. Allen Curran, Geosciences

Figure 1: A cross section of an Acropora cervicornis coral with encrusters from Cockburn Town Fossil Reef on San Salvador. A) The original sample. B) The same sample analyzed using ImageJ to illustrate the presence of the coral (dark blue, 6.7%), RCC algae (red, 3.4%), foraminifera (light blue, 1.5%), stromatolites (purple, 43.8%), clotted microbialites (green, 42.8%), and mollusks/macroborings (pink, 0.05%).

SURF 2018-Post SURF Survey

Name	Heather McQueen
Year of Graduation	2018

Are you in a Graduate program?	no
SURF Advisor	Kevin Shea, Chemistry
Advisor Department	Chemistry
SURF Field of Study	Chemistry
Please list co-authors of your abstract	Suzie Smith
Upload image(s) in .png format; 1,100 MB max size each	

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Title of Abstract/Research	The Chemistry of Crochet and Koalas

Please type your abstract below.

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