2021

Summer Research Fellowship Project Descriptions 2021

Clark Science Center's Summer Research Fellows Program

Clark Science Center @Smith College

2021 SURF Project Descriptions

SURF Abstract Submission & Post Program Survey 2020

Name Amelia Olsen

Year of Graduation 2022

SURF Advisor Sara Pruss, Geosciences

SURF Field of Study

Title of Abstract/Research Animal abundance and changing redox conditions during the Furongian Cambrian SPICE Event, western Utah

Please type your abstract below.

The Steptoean Positive Isotopic Carbon Excursion (SPICE) has been documented in late Cambrian stratigraphic sections worldwide. The onset of the SPICE aligns with a global extinction event of trilobites, marking the Marjumiid-Pterocephaliid biomere boundary. Although the cause of both the excursion and the extinction event are debated, multiple lines of evidence suggest changes in ocean redox conditions may have been responsible. The House Range and Lawson Cove sections in western Utah are two of the localities where the SPICE event was first reported. These sections are comparatively fossiliferous among units recording the SPICE event.

This summer, we returned to both sections, to closer examine the change in facies through the outcrop, where samples were taken during SURF 2019. Geochemical data including mercury, carbon isotopes, and total organic carbon were examined alongside fossil data from strata that span the SPICE event at both localities. We used geochemical redox proxies to better understand the timing of local environmental changes during the SPICE. Through thin-section analysis, we determined skeletal abundance and diversity through both sections to ascertain how the SPICE event and concurrent environmental changes influenced marine organisms. Samples were dissolved in acetic acid with the goal of isolating and identifying microfossils. By coupling evidence for environmental changes with animal abundance and diversity, we hope to better constrain one of the best known yet still poorly understood carbon isotopic excursions of the Cambrian. This research will continue into the 2021-22 academic year.

SURF Abstract Submission & Post Program Survey 2020

Name	Marium Tapal
Year of Graduation	2022
SURF Advisor	Katie Kinnaird; Computer Science
SURF Field of Study	Computer Science

Title of Abstract/Research repytah: An open-source Python package that builds aligned hierarchies for sequential data streams

Please type your abstract below.

Sequential data streams often have repeated elements that build on each other, creating inherent hierarchies. The goal of extracting these repetitions and their relationships to each other in order to build aligned hierarchies was introduced in Katherine M. Kinnaird's thesis Aligned Hierarchies for Sequential Data. The Python package repytah, a translation of Kinnaird's original MATLAB code, aims to fulfill this task. This summer, we focused on improving the existing work from the past two years and aimed towards deploying the work as a finalized Python package. First, we optimized the code of the four modules and the example in the package as well as updated the package structure. With the modules being revised, we also revised the corresponding vignettes and test files to make sure all the modules work as intended. In this final stage of the project, we worked on package production so that our code is installable via standard tools such as pip and conda. We also created a website that documents the code, and wrote a paper outlining the package to be submitted with the code for peer-review to the Journal of Open Source Software. Future steps for this project include further developing the package to include derivatives of aligned hierarchies.

SURF Abstract Submission & Post Program Survey 2020

Name	Giovanna Sabini-Leite
Year of Graduation	2022
SURF Advisor	Rachel Wright; Biological Sciences
SURF Field of Study	Biology

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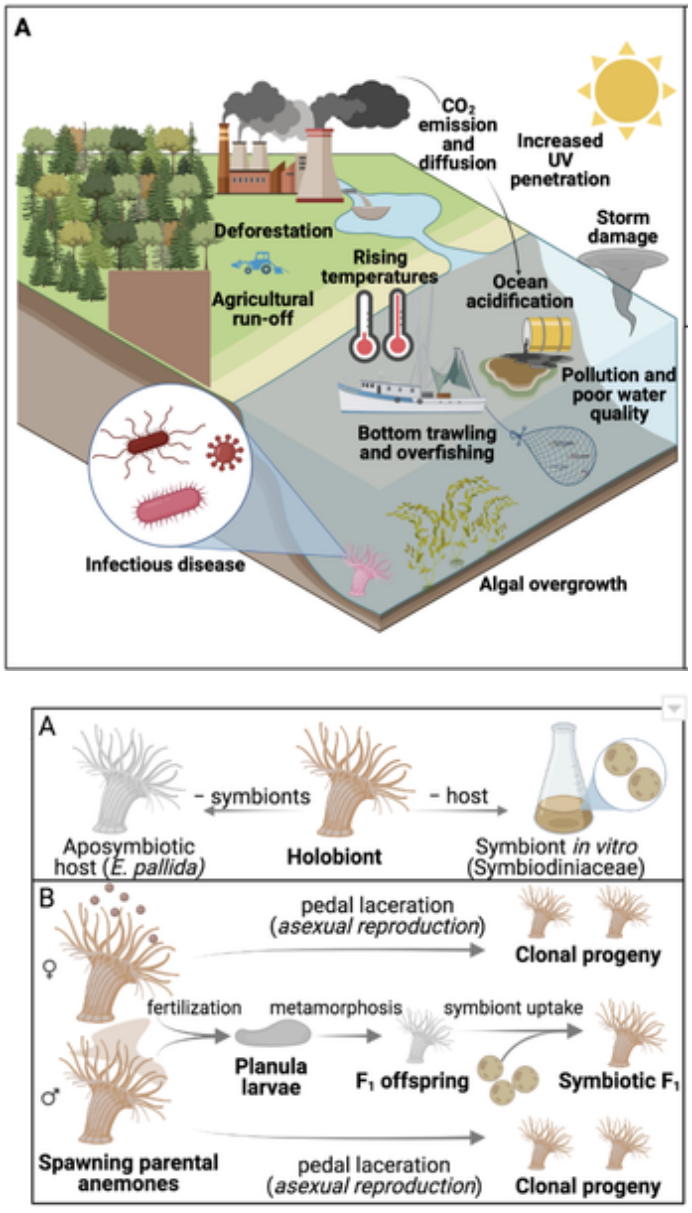


Fig. N: Introduction to the *Exaiptasia pallida* model system. (A) Anemone hosts and algal symbionts can be reared together (holobiont) or separately. (B) Anemones generate progeny through asexual and sexual reproduction. Figure generated in BioRender by G. Sabini-Leite '21.

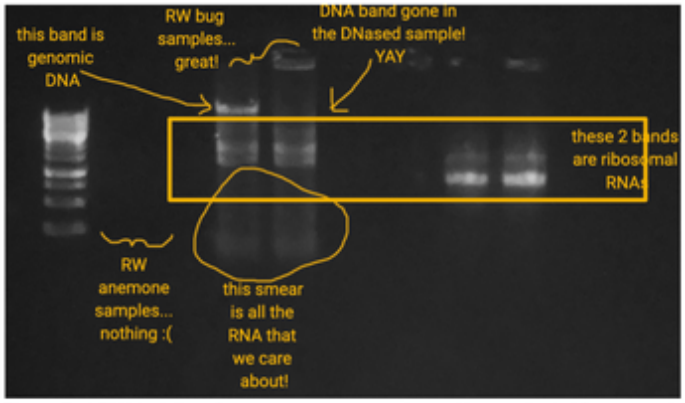


Figure: Test RNA isolations from our anemone samples and bugs collected from around campus.

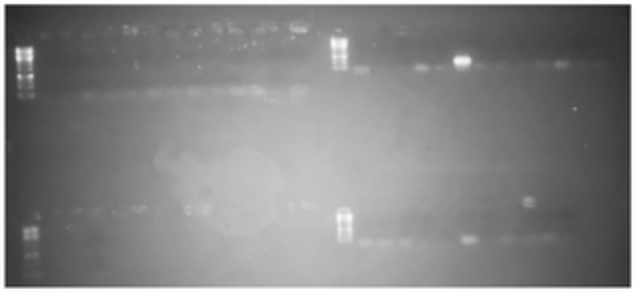
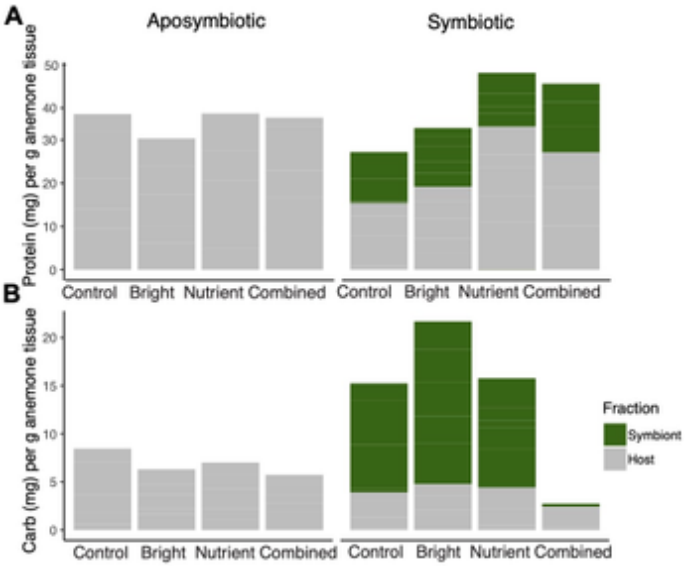


Figure: Test cDNA amplification gels. We were looking for a smear of amplified cDNA but we did not see that smear for any samples indicating that the first-strand cDNA synthesis or cDNA amplification protocol is not working.



Title of Abstract/Research SURF 2021 Continuation of Thesis Research

Please type your abstract below.

The goal of this SURF was to continue my thesis research, insights into and effects of bleaching under light and nutrient stress in the sea anemone Exaiptasia pallida. Adverse conditions may lead to chemical or nutritional imbalances that disrupt the mutualistic relationship between the anemone host and its algal endosymbionts (family Symbiodiniaceae). Preserved anemone tissue from my thesis revealed more subtle changes to anemone physiology that were not detected when analyzing mortality and algal density. In expanding upon the scope of the thesis, I analyzed total host and symbiont protein and carbohydrate levels to assay metabolic changes in the anemone hosts. RNA and DNA from the preserved samples were also isolated. This step involved a lot of trial and error, and testing several extraction protocols. However, we could not confidently send our samples in for gene expression analysis given the low RNA quality. Future students will repeat the experiment to sample anemones more quickly and use our new isolation protocols to improve RNA quality. Lastly, my efforts focused

on literature research, working on our lab website, and creating figures illustrating conceptual frameworks and experimental designs for Dr. Wright's grant funding future research.

SURF Abstract Submission & Post Program Survey 2020

Name	Chenhui Jia
Year of Graduation	2023
SURF Advisor	Katie Kinnaird; Computer Science
SURF Field of Study	Computer Science
Please list co-authors of your abstract (if applicable)	Chenhui Jia, Zoie Zhao, Betty Wang, Thu Tran, Marium Tapal

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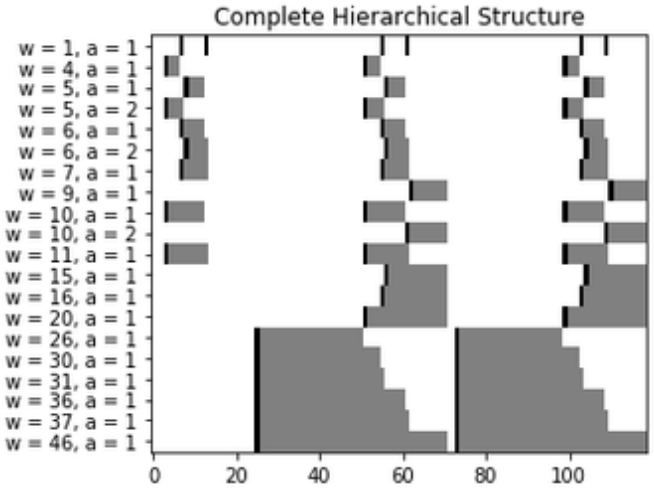

Title of Abstract/Research

repytah: An open-source Python package that builds aligned hierarchies for sequential data streams

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SURF Abstract Submission & Post Program Survey 2020

Name	Thu Tran
Year of Graduation	2024
SURF Advisor	Katie Kinnaird; Computer Science
SURF Field of Study	Computer Science, Statistical & Data Sciences
Please list co-authors of your abstract (if applicable)	Betty Wang, Chenhui Jia, Marium Tapal, Zoie Zhao

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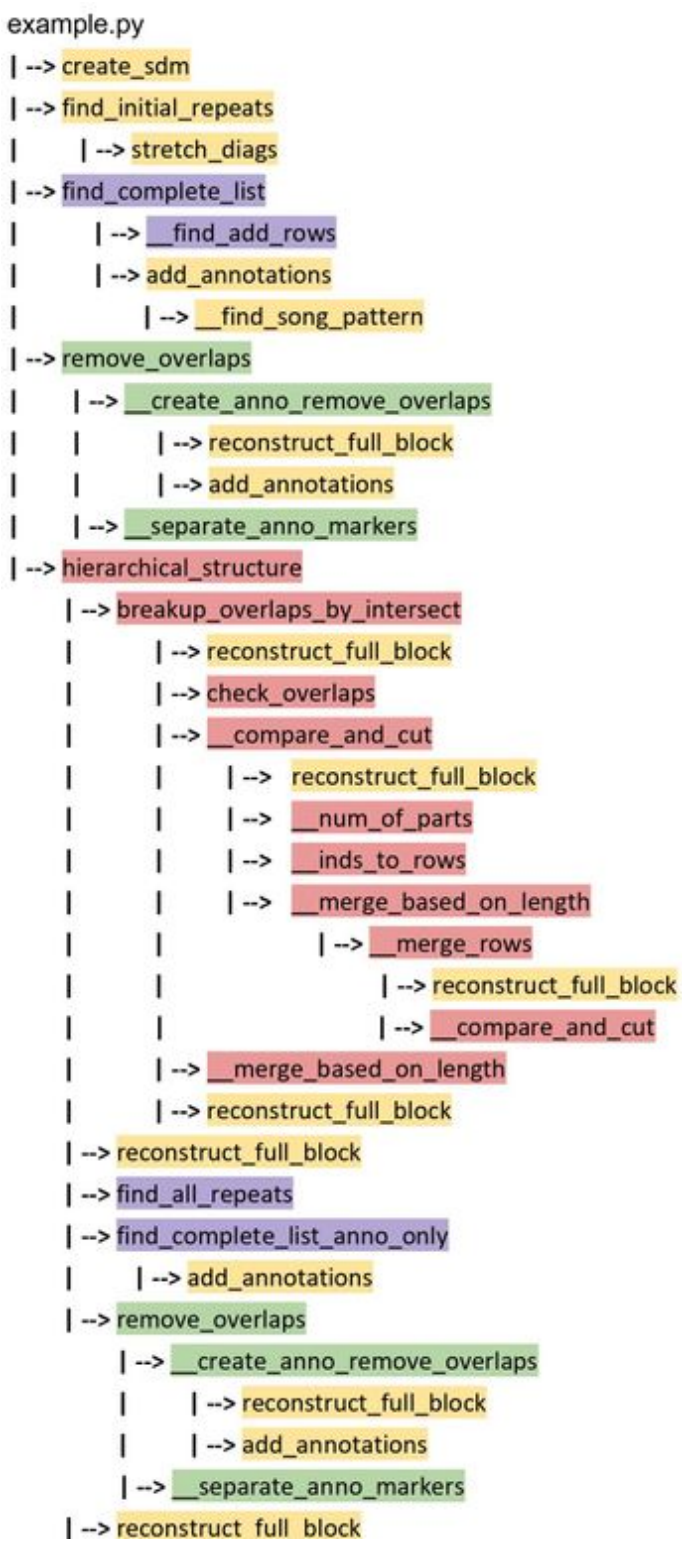

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SURF Abstract Submission & Post Program Survey 2020

Name	Eleni Partakki
Year of Graduation	2022
SURF Advisor	Jordan Crouser; Computer Science
SURF Field of Study	Computer Science
Title of Abstract/Research	Smith College HCV Lab: Adaptive Filtering and Visual Literacy

Please type your abstract below.

During my time in the HCV Lab this summer, alongside other lab members, we selected 2-3 main projects to invest our time with. My main two projects were Adaptive Filtering and Visual Literacy.

For Adaptive Filtering, I had worked with Ph.D. students from Washington University to implement two different tasks. For the first task, we asked whether we could model users to provide suggestions with algorithms. To approach this task, I implemented an algorithm from David Goltz's paper on modeling analytic focus, while utilizing Emily Wall's and Alvitta Ottley's research. Our result was to make an argument as to whether we could leverage existing models to power suggesting engines while tracking the strengths and weaknesses of prior models in order to select the one with the best suggestions.

For the second task, we asked whether these suggestions could impact data exploration and how do they affect exploration strategies? We explored this problem space in terms of (a) actions people tend to perform, and (b) data points they explore/ignore, with and without suggestions. This was a system building and user study part of the project. We needed to refine the existing tools we found from the first task and create new tasks and a platform for user study testing.

In regards to the Visual Literacy project, I worked with Ph.D. students from Tufts University in designing a research project that would answer questions about visual literacy in the visualization community. The vast majority of the summer was spent researching papers and tracking similarities and differences in techniques used to measure visual understanding and literacy among adults and children alike.

Lastly, I spent the summer supporting my lab partners with their projects and questions and contributed in creating a fun and engaging environment for learning in the HCV Lab.

SURF Abstract Submission & Post Program Survey 2020

Name	Abigail Wilcox
Year of Graduation	2024
SURF Advisor	Samantha Torquato; Biological Sciences
SURF Field of Study	Biological Sciences
Title of Abstract/Research	The Identification of Marine Mammal Parasitic Nematode Species

Please type your abstract below.

Otostrongylus circumlitis is a parasitic nematode that infects Harbor seals and Northern elephant seals. In both marine mammal species, O. circumlitis is a lungworm; however, in the Northern elephant seal, the nematode manifests as a heartworm. While lungworm infections are usually non-life threatening and manifest below clinical level for adult seals, heartworm infections are fatal as they cause inflammation and disseminated intravascular coagulation, a condition marked by excessive bleeding and irregular clotting. In order to treat these animals, a diagnostic assay that is specific to O. circumlitis and sensitive enough to detect low-grade infections must be developed.
This summer was spent extracting genomic (g)DNA from worm samples recovered from necropsies of different seals and sea lions along both coasts. Then, PCR was performed with three different evolutionary primer sets on the isolated gDNA in order to amplify three genomic regions associated with the following genes: SSU, DIDR/ITS2, and COX1/COI. Sanger sequencing was performed on the resulting PCR products. Finally, these sequences were analyzed via the NCBI BLAST database in order to identify the associated worm species. Two Anisakis spp. worms and two O. circumlitis worms were discovered through these methods. The now identified gDNA will be used as positive and negative controls in developing the O. circumlitis diagnostic assay.
Future work will include Sanger sequencing additional nematode gDNA samples. Also, bioinformatics analyses will be completed in order to determine which repetitive sequence within the O. circumlitis genome can be targeted for diagnostic purposes. From there, the newly developed assay will be tested for sensitivity and specificity.

Citations:

Elson-Riggins, J. G., Al-Banna, L., Platzer, E. G., & Kaloshian, I. (2001). Characterization of Otostrongylus circumlitus from Pacific Harbor and Northern Elephant Seals. The Journal of Parasitology, 87(1), 73. https://doi.org/10.2307/3285177
Moake, J. L. (2020, January). Disseminated Intravascular Coagulation (DIC) - Blood Disorders. Merck Manuals Consumer Version. https://www.merckmanuals.com/home/blood-disorders/bleeding-due-to-clotting-disorders/disseminated-intravascular-coagulation-dic.
Williams, K. (2018). Different Coasts and Different Hosts: Investigating Speciation in the Seal Lungworm Otostrongylus circumlitis (thesis).

SURF Abstract Submission & Post Program Survey 2020

Name	Eva Schenck
Year of Graduation	2023
SURF Advisor	Jordan Crouser, Computer Science
SURF Field of Study	Computer science
Title of Abstract/Research	HCV Lab -- Bayesian Reasoning & GANs

Please type your abstract below.

So much of this summer has been working on two different Bayesian reasoning problems. Bayesian reasoning – which is essentially reasoning problems about conditional probability – is difficult for most people, but has huge implications for real-life decision making. In the projects I worked on with the PhD researchers Ab Mosca and Mel Bancilhon, we mostly focused on Bayesian reasoning around medical diagnoses – if someone is diagnosed with a given disease, but the diagnosis test has some chance of false positives, what is the chance they actually have that disease? On the other hand, someone could receive a false negative test result for that disease. When I started on these projects at the beginning of the summer, they had both been going on for a while and conducted pilot studies. My task was first to understand what they'd been doing – read background papers, look over their code and previous findings – and I learned about how to pick up from other people's earlier work. I came into the summer fairly confident in data wrangling, analysis, and visualization, but through these projects improved by working with real-life, messy data. Even more importantly, I learned how to think about this work – how do we combine two different variables into one metric for success? In designing a new study, how can we predict participants' actions and write questions that interest them? I also began to think about questions that I might want to answer about how real people respond to data and information, and started learning new tools (like !) to work towards these goals.

The third project I worked on this summer was a personal side project on GANs, generative adversarial networks, with two fellow SURF students in the lab. GANs are a type of machine learning that can generate new content by passing information back and forth between two competing computers. When we mentioned interest in this topic to our professor Jordan, he helped us find resources, but allowed us to figure it out on our own. While the least "productive" of the projects I worked on, this is where I learned the most. Together, we improved our basic Python skills and built a basic machine learning model in only a few weeks, and plan to continue researching and improving in order to produce GAN images in the future. I had never anticipated this path for the summer, but I grew because of it.

SURF Abstract Submission & Post Program Survey 2020

Name	KeXin Zhao
Year of Graduation	2024
SURF Advisor	Katie Kinnaird; Computer Science
If your SURF Advisor was not listed above you can enter their name here.	
SURF Field of Study	Computer Science

Please list co-authors of your abstract (if applicable) Chenhui Jia, Zoie Zhao, Betty Wang, Thu Tran, Marium Tapal.

Title of Abstract/Research repytah: An open-source Python package that builds aligned hierarchies for sequential data streams

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SURF Abstract Submission & Post Program Survey 2020

Name	Ivy Chen
Year of Graduation	2022
SURF Advisor	Jordan Crouser; Computer Science
SURF Field of Study	Computer Science + SDS
Title of Abstract/Research	Smith College HCV Lab: Supporting Bayesian Reasoning Analysis

Please type your abstract below.

Throughout the summer, we conducted several experiments on different Bayesian Reasoning surveys to see which design increases the correctness of one's answer. There are mainly five parts that I worked on: scenario design, testing, user studies, data analysis, and webpage interface design. Our goal was to engage our participants in the survey because we believe that if we were able to make the survey more interesting, people might be more willing to pay attention to the survey; therefore, this enhances their possibility to get the correct answers. The two main scenario topics that we settled down were education and politics. When designing the scenarios, we edited the texts to make the wordings as consistent as possible. Additionally, when running the user study, we took detailed notes about how the participants approached their final answers. Also, participants gave us feedback on which parts of the survey were confusing and have typos/ mistakes. These helped us to recognize the parts that needed to be polished in the survey.

In the survey, two kinds of questions were asked: the attention check and the bayes question. The attention check question was really straightforward and helped us to filter out participants who were not answering the survey seriously. This means that the data we collect from them might not be informative. By analyzing the data we collected, we concluded that visualization and text helped the participants to attain correct answers most easily. Apart from this, we discovered that the correctness of answers, dprime, and time spent on the page were not significantly correlated with the three types of layout: visualization only, text only, and a combination of visualization and text. We inferred that it was due to our sample data was relatively small. For the webpage design, we used JavaScript and Redis. We put the text, corresponding visualizations, and questions onto each page while those three types of layouts were randomly assigned. Besides, we created a drag and drop page for the user to rank their most to least interested scenarios. Another side project was the visual memory test. We designed four squares which will appear twice with either one square randomly changes color or four of them remain the same. Then we ask the user if anything has changed.

SURF Abstract Submission & Post Program Survey 2020

Name	Clara Wong
Year of Graduation	2022
SURF Advisor	Sara Pruss; Geosciences
SURF Field of Study	Geosciences
Title of Abstract/Research	Tubular fossils from the late Ediacaran La Ciénega Formation, Sonora, Mexico

Please type your abstract below.

The terminal Ediacaran Period hosts a diversity of cloudinomorphic and other millimeter-scale tubular fossils, which are thought to be among the earliest biomineralizing metazoans.Selectively to fully silicified cloudinomorph and tubular fossils are preserved as dense polytaxic packstone/wackestone accumulations in a <5-meter interval of cross-bedded dolostone within the terminal Ediacaran La Ciénega Formation in Sonora, Mexico. Samples of this unit were dissolved in dilute acetic acid and the residues were imaged using a scanning electron microscope. Block samples were also sent to be volume imaged using x-ray tomographic microscopy. Over 100 extracted specimens of tubular fossils and fragments were examined and sorted into groups by morphology. Specimens which had blunt or flared nested funnels (n = 27 and 26, respectively) are tentatively grouped as two distinct morphologies of Cloudina, and annulated tubes (n = 35) were grouped as probable Sinotubulites. Other specimens were smooth-walled and appear similar to Cambrotubulus, which were grouped into either straight or curved morphologies (n = 20 and 11, respectively). Additionally, there were at least 25 ambiguous samples that we could not assign to any generic group. Specimens grouped as Cloudina- and Sinotubulites-like occasionally demonstrated twisted and compressed structures as well as elliptical cross sections, which we interpret as plastic deformation prior to taphonomic silicification, suggesting that these tubes were likely flexible in vivo.

SURF Abstract Submission & Post Program Survey 2020

Name	Yingke Wang
Year of Graduation	2023
SURF Advisor	Katie Kinnaird; Computer Science
SURF Field of Study	Computer Science
Please list co-authors of your abstract (if applicable)	Chenhui Jia, Thu Tran, Marium Tapal, Zoie Zhao

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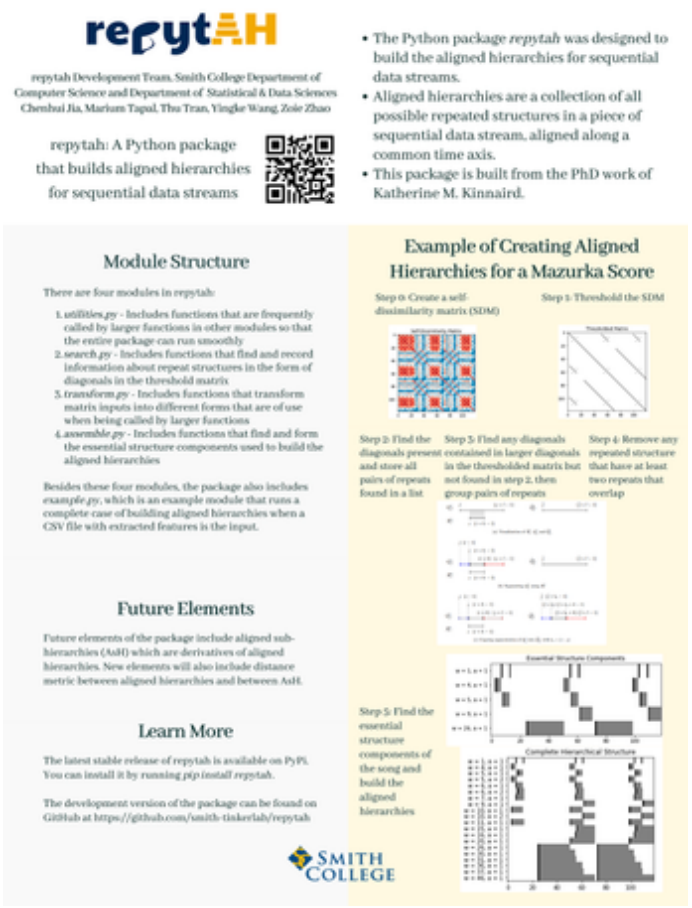

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Name	Yingke Wang
Year of Graduation	2023
SURF Advisor	Katie Kinnaird; Computer Science
SURF Field of Study	Computer Science
Please list co-authors of your abstract (if applicable)	Chenhui Jia, Thu Tran, Marium Tapal, Zoie Zhao

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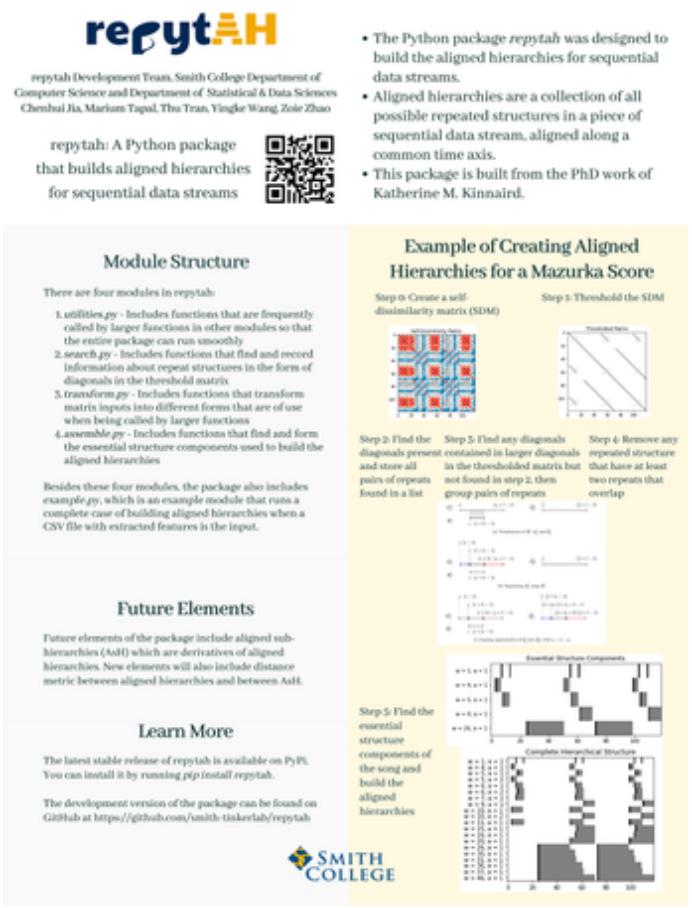

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SURF Abstract Submission & Post Program Survey 2020

Name	Audrey Su
Year of Graduation	2024
SURF Advisor	Denise Lello; Biological Sciences
SURF Field of Study	Biological Sciences
Please list co-authors of your abstract (if applicable)	Asli Ali

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Title of Abstract/Research

Researching the Impacts of Climate Change on Fall Phenology at the MacLeish Field Station

Please type your abstract below.

Fall phenology, such as leaf senescence and animal dormancy, has received less attention by researchers relative to spring activity. This multifactorial, long-term research project tracks fall phenological events in six study plots at the MacLeish Field Station in Whately, Massachusetts. The six plots include two dominated by hemlock, two sites occupied by young birch and maple, and two sites that are mature black birch forests. This data would be compared to better understand biogeological interactions of each microclimate. Specifically, measurements include chlorophyll, leaf litter and soil sample masses, leaf color and percent retention, and mesofauna identification. A more holistic understanding of the environmental changes of the MacLeish Field Station is sought after through data acquisition from this summer and comparisons of the previous autumnal seasons.

Over the summer, our research included both lab and fieldwork. Lab work consisted of mesofauna research and identification, data entry, and data analysis. Mesofauna from soil samples taken in previous summers were identified to the lowest taxon level possible and then preserved. To address the paucity of research on soil biota, we took photos of mesofauna from the soil samples. Photos were arranged into an identification guide and poster to serve as a reference for future students participating in the research, particularly in courses taught by Professor Lello. We also transferred data from raw data sheets into online spreadsheets. Using this data, we investigated the relationship between moisture levels in the soil across different years, and whether or not moisture may impact salamander abundance across the selected plots in MacLeish. Significant time was spent in the field maintaining plot equipment and sampling data. We collaborated with interns at CEEDS to construct wooden frames for leaf litter sample collection in the fall. Other site maintenance included coverboard repair and moisture sensor replacement. In June and July we performed two coverboard censuses, and also collected soil samples at each site. These summer samples provide a comparison to the samples collected in the fall.

Our research contributes to this long-term project that ultimately seeks to better understand fall phenology and how climate change is impacting processes such as nutrient cycling, biological decomposition, and net productivity of temperate forests. Furthermore, our efforts to document mesofauna will provide information regarding terrestrial invertebrate diversity. Our 2021 SURF experience gave us the opportunity to contribute important information to neglected areas of research including fall phenology and soil mesofauna responses to climate change.

SURF Abstract Submission & Post Program Survey 2020

Name	Asli Ali
Year of Graduation	2022
SURF Advisor	Denise Lello; Biological Sciences
SURF Field of Study	Biological Sciences
Please list co-authors of your abstract (if applicable)	Audrey Su

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Fall phenology, such as leaf senescence and animal dormancy, has received less attention from researchers relative to spring activity. This multifactorial, long-term research project tracks fall phenological events in six study plots at the MacLeish Field Station in Whately, Massachusetts. The six plots include two dominated by hemlock, two sites occupied by young birch and maple, and two sites that are mature black birch forests. This data would be compared to better understand biogeological interactions of each microclimate. Specifically, measurements include chlorophyll, leaf litter and soil sample masses, leaf color and percent retention, and mesofauna identification. A more holistic understanding of the environmental changes of the MacLeish Field Station is sought after through data acquisition from this summer and comparisons of the previous autumnal seasons.

Over the summer, our research included both lab and fieldwork. Lab work consisted of mesofauna research and identification, data entry, and data analysis. Mesofauna from soil samples taken in previous summers were identified to the lowest taxon level possible and then preserved. To address the paucity of research on soil biota, we took photos of mesofauna from the soil samples. Photos were arranged into an identification guide and poster to serve as a reference for future students participating in the research, particularly in courses taught by Professor Lello. We also transferred data from raw data sheets into online spreadsheets. Using this data, we investigated the relationship between moisture levels in the soil across different years, and whether or not moisture may impact salamander abundance across the selected plots in MacLeish. Significant time was spent in the field maintaining plot equipment and sampling data. We collaborated with interns at CEEDS to construct wooden frames for leaf litter sample collection in the fall. Other site maintenance included coverboard repair and moisture sensor replacement. In June and July we performed two coverboard censuses, and also collected soil samples at each site. These summer samples provide a comparison to the samples collected in the fall.

Our research contributes to this long-term project that ultimately seeks to better understand fall phenology and how climate change is impacting processes such as nutrient cycling, biological decomposition, and net productivity of temperate forests. Furthermore, our efforts to document mesofauna will provide information regarding terrestrial invertebrate diversity. Our 2021 SURF experience gave us the opportunity to contribute important information to neglected areas of research including fall phenology and soil mesofauna responses to climate change.

SURF Abstract Submission & Post Program Survey 2020

Name	Anna Pearson
Year of Graduation	2022
SURF Advisor	Jack Loveless; Geosciences
SURF Field of Study	Geosciences
Title of Abstract/Research	Investigating Strike-Slip Faulting Parallel to the Icelandic Plate Boundary Using Boundary Element Models

Please type your abstract below.

For my SURF project, I rewrote my senior thesis to create a journal article which I then submitted to Tectonics (a journal published by the American Geophysical Union). That article is currently under review. The abstract written for that article is as follows: Most faults in Iceland strike roughly parallel to the divergent plate boundary, a part of the Mid-Atlantic Rift, which would be expected to lead to primarily normal faulting. However, several studies have observed a significant component of rift-parallel strike-slip faulting in Iceland. To investigate these fault kinematics, we use the boundary element method to model fault slip and crustal stress patterns of the Icelandic tectonic system, including a spherical hotspot and uniaxial stress that represents rifting. On a network of faults, we estimate the slip required to relieve traction imposed by hotspot inflation and remote stress and compare the model results with observed slip kinematics, crustal seismicity, and geodetic data. We note a good fit between model-predicted and observed deformation metrics, with both indicating significant components of normal and strike-slip faulting as well as consistency between recent data and longer-term records of geologic fault slip. Possible stress permutations between steeply plunging $\sigma 1$ and $\sigma 2$ axes are common in our models, suggesting that localized stress perturbations may impact strike-slip faulting. Some increases in model complexity, including older hotspot configurations and allowing fault opening to simulate dike intrusion, show improvement to model fit in select regions. This work provides new insight into the physical mechanisms driving faulting styles within Iceland away from the current active plate boundary, implying that a significant portion of observed strike-slip faulting is likely caused by the combined effects of tectonic rifting, hotspot impacts, and mechanical interactions across the fault network.

SURF Abstract Submission & Post Program Survey 2020

Name	Miriam Boardman
Year of Graduation	2023
SURF Advisor	Bosiljka Glumac; Geosciences
SURF Field of Study	Geosciences
Title of Abstract/Research	MODIFICATION OF PLEISTOCENE CARBONATE REEF DEPOSITS BY BIOEROSION OF CORALS: INSIGHTS FROM NEW CORE DATA, SAN SALVADOR ISLAND, BAHAMAS

Please type your abstract below.

This research focuses on bioerosion of corals present within a new 54 mm-diameter core through a Pleistocene (Last Interglacial; MIS5) coral reef from the Cockburn Town Member of the Grotto Beach Formation at The Gulf site on the south coast of San Salvador Island, Bahamas. The main research objectives are to document evidence of bioerosion of the fossil corals and to determine the impact of bioerosion in producing secondary porosity within the coral structure and in generating carbonate sediment. Thin-section image analysis was used to quantify the amount of primary porosity within different corals present in the core and the alteration of porosity by the processes and products of bioerosion, specifically by lithophagid bivalves and clionid sponges, with implications for modifications of reservoir properties of these reefal rocks.

Image analysis of high-resolution scans of petrographic thin sections included use of Adobe Illustrator to document the distribution of various components within the coral structure: corallites (coral skeletal material), primary and secondary porosity, carbonate cement (acicular aragonite), carbonate sediment (micrite and skeletal, peloidal and ooid sand), and angular coral silt to very fine sand (up to 80 microns in diameter). Fiji/ImageJ software was then used to quantify the abundances (% surface area) of these individual components.

The area occupied by corallites and the amount of primary porosity within the coral structure depend on the type of coral: e.g., Acropora cervicornis can have ~15% primary porosity, while Colpophylia natans may have more than 40%. The amount of secondary porosity, mainly in the form of lithophagid bore holes, can be extensive and modify nearly 75% of the coral structure. Cement is a minor component (usually <1%), but carbonate sediment has infilled up to 60% of the pores within corals. Observed transitions from unaltered to severely fragmented corallites and the presence of coral silt/fine sand fragments in small, dense clusters and scattered in the sediment infilling and surrounding the corals, suggest that they are “chips" made by clionid sponges boring into the coral surfaces. Such bioerosion chips can occupy up to 5% of a sample, and even though volumetrically relatively small, they are an ubiquitous and important component of these reefal deposits.

SURF Abstract Submission & Post Program Survey 2020

Name	Sierra Weirens
Year of Graduation	2023
SURF Advisor	Bosiljka Glumac; Geosciences
SURF Field of Study	Geosciences

Abstract of Research Results
As part of the terms of your summer stipend, it is required that you submit an abstract with your research results, not to exceed 400 words and include a picture/diagram whenpossible. We will ask you to resubmit your abstract if it exceeds 400 words. Approval of your abstract by your advisor is required prior to submission. No edits will be made to your abstract after you submit it here.
Certainly we understand that with the range of projects and durations while doing this remotely, some may be more of a brief project description rather than a formal abstract. This is completely acceptable.

You can find sample abstracts from previous years here.

Title of Abstract/Research	Encrusters on Pleistocene Corals From the Bahamas: New Data From a Core on San Salvador and Comparison With Outcrop Observations From Great Inagua and San Salvador

Islands

Please type your abstract below.

This research examines distribution, type and abundance of encrusters on corals from a core through a Pleistocene (MIS5) reef at The Gulf site on the south coast of San Salvador. Results are compared with data from outcrop samples of the Eemian (MIS 5e) Cockburn Town Mbr. (Grotto Beach Fm.) at the Cockburn Town Fossil Reef (CTFR) site on San Salvador's west coast and from Devil's Point (DP) and Matthew Town Marina on Great Inagua. Our goal was to evaluate environmental conditions during the last interglacial that resulted in coral encrustation and elucidate the role of encrusters in modifying reservoir properties of reefal rocks.

High-resolution scans of petrographic thin sections from core samples were analyzed in Adobe Illustrator to document the distribution of encrusters (red algae, foraminifera, serpulids, and microbial coatings), and Fiji/ImageJ software was used to quantify their abundances (% surface area). Corals (Acropora cervicornis, Orbicella annularis, and Colpophyllia natans) occupy up to ~75% of samples analyzed. Red algae encrust directly onto corals, make up to ~35% of samples and form crusts up to 1.5 cm thick. Scattered among and on top of algal crusts are encrusting foraminifera (Homotrema rubra, Carpenteria utricularis, Planogypsina acervalis, Gypsina plana), covering 1-10% of all samples. Serpulids have similar distribution but occupy a smaller area (0-8%). Microbialites are present in 40% of samples, covering up to ~45% of area, succeeding red algae, and incorporating encrusting foraminifera. In core samples, laminated microbialites form crusts up to 14 cm thick on A. cervicornis corals near top of the reef.

In comparison, CTFR and DP outcrops expose the Devil's Point discontinuity separating Reefs I and II. CTFR Reef I has A. cervicornis with microbial encusters up to 9 cm thick, in addition to red algae and foraminifera, whereas DP Reef I lacks thick encrustation. CTFR and DP Reef II corals range from pristine to moderately encrusted by red algae and foraminifera only. Corals from dredged boulders at the Marina site bear all encruster types, suggesting a localized setting for microbialite development. Even though locally distributed, thick microbial encrusters can occupy a substantial portion of reefs and indicate increased coral stress related to temperature and sea level fluctuations.

SURF Abstract Submission & Post Program Survey 2020

Name	Yutong Zhang
Year of Graduation	2023
SURF Advisor	Jordan Crouser; Computer Scienc<
SURF Field of Study	Human Computation Visualization
Title of Abstract/Research	Smith College Human Computation and Visualization Lab: Bayesian Reasoning

Please type your abstract below.

My work this summer focuses on using visualization to improve people's performance on Bayesian reasoning, which includes running user studies, conducting data analysis, coding for the platform / interface where users interact with the surveys, and designing questions for next pilots.

I analyzed the data collected from previous user studies and found that the proportion of people who interacted and got both Bayes Reasoning Questions correct was 30.9%, which was about three times the proportion of people who didn't interact and got both Bayes Reasoning Qs correct, which was only 9.5%. And interaction improves the correctness of Q1 more than that of Q2. For those who got Q1 correct, the proportion of people who didn't interact was 9.5%, which increased to 43.6% for those who interacted. Whereas, for those who got Q2 correct, the proportion of people who didn't interact was 19.0%, which increased to 40% for those who interacted.

The coding group added six new scenarios (including texts and their corresponding visualizations) to the code. I was responsible for coding the dui (driving under the influence) scenario. We coded in on visual studio and practiced GitHub collaboration. I, with help from Zampa, also coded for an extra Visual Memory Test where we ask the users to indicate whether 4 randomly colored squares change after several milliseconds of blockage following their display. If yes, one of the four squares would change to another random color. The test can be repeated an arbitrary number of times by setting the value of a variable in the code. A Next button reveals only after the users enter their judgement for each round; they can pause to get ready for the next round. The button won't show up if the repetition is reached. A list of 0s and 1s records users' correctness.

From the two user studies I ran, I was able to pinpoint which aspect of our platform could be improved. For instance, one of my users didn't use the visualization much because without indexing columns, counting ends up taking more effort than extracting information from the text.

To minimize data noise, it is necessary to sustain consistency amongst scenarios/pilots at question design. We researched and came up with 3 questions in politics and higher-education, respectively. In this non-technical part of the project, I dug into the way that Bayesian reasoning questions are presented.

SURF Abstract Submission & Post Program Survey 2020

Name	Hannah Durkee
Year of Graduation	2022
SURF Advisor	Susan Voss; Engineerin<
SURF Field of Study	Engineering
Please list co-authors of your abstract (if applicable)	Mealaktey Sok

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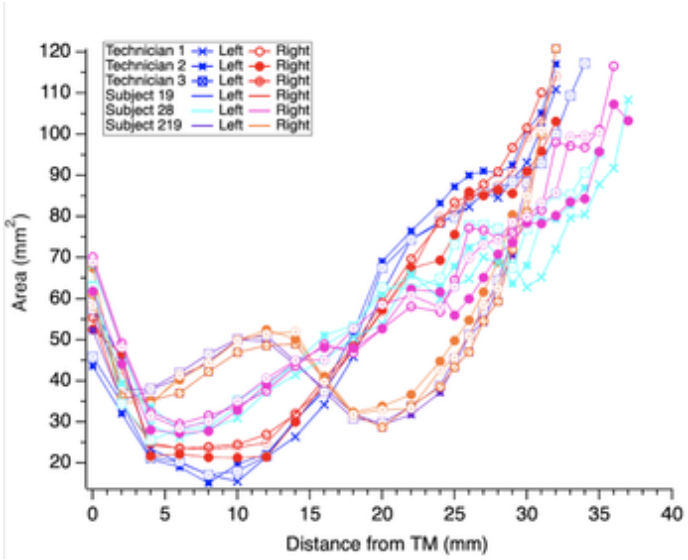

Title of Abstract/Research Ear Canal Area measurements from CT scans

Please type your abstract below.

Non-invasive wideband acoustic immittance (WAI) measurements are a tool for diagnosing middle ear disorders. These WAI measures require the subject's ear-canal area in order to calculate several relevant diagnostic quantities. Currently, industry-standard values for area are considerably smaller than the values collected in this work. Only a few previous studies have collected measurements of the ear canal from live ears and used clear definitions for the entrance and termination.

This work used the ear-canal area measurement method developed by Auden Balouch in her Smith College honors thesis (2021),to measure ear-canal areas and lengths from a data set of CT scans collected by Dr. Aaron Remenschneider from UMASS Memorial Medical Center. This approach used the multi-planar reconstruction and measurement tools in the software program, OsiriX CT, to view and take measurements every 1-2 mm from the entrance to the termination of the canal.

During the summer SURF program of 2021, measurements were made on 24 ears (from 13 subjects) by two technicians. Measurements on a single ear took 5-7 hours to complete. Each technician made her measurements blinded from other measurements on the same ear. Using the software packages MatLab and Igor, plots that showcase the validity and reliability of Auden's method were made. These plots demonstrate how similar the blind data collections are to each other, which helps to validate the accuracy of Auden's method. We also created a video tutorial of Auden's method. This video, linked below, includes the basic setup and navigation of the software, as well as a step-by-step introduction on how to begin the first, second, third, and final measurements on the ear, and what things to look out for. The ears measured were from a set of 110 total ears. In the fall we will continue to work to measure the remaining 86 other ears in this data set.

Video Tutorial https://drive.google.com/drive/folders/1VWzb2xhu-Lv6MW2327DSyp0ZYNdmbQ0F?usp=sharing

SURF Abstract Submission & Post Program Survey 2020

Name	Anna Maffa
Year of Graduation	2023
SURF Advisor	Brianna McMillan; Psychology
SURF Field of Study	Psychology
Please list co-authors of your abstract (if applicable)	Beth Campbell, Iliana Pliska-Block, and Carmen Villalobos Guevara

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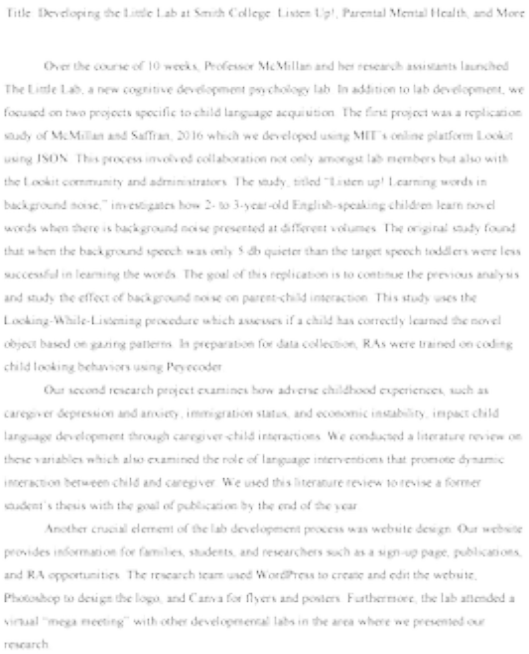

Title: Developing the Little Lab at Smith College: Listen Up!, Parental Mental Health, and More

Over the course of 10 weeks, Professor McMillan and her research assistants launched The Little Lab, a new cognitive development psychology lab. In addition to lab development, we focused on two projects specific to child language acquisition. The first project was a replication study of McMillan and Saffran, 2016 which we developed using MIT's online platform Lookit using JSON. This process involved collaboration not only amongst lab members but also with the Lookit community and administrators. The study, titled "Listen up! Learning words in background noise," investigates how 2- to 3-year-old English-speaking children learn novel words when there is background noise presented at different volumes. The original study found that when the background speech was only 5 db quieter than the target speech toddlers were less successful in learning the words. The goal of this replication is to continue the previous analysis and study the effect of background noise on parent-child interaction. This study uses the Looking-While-Listening procedure which assesses if a child has correctly learned the novel object based on gazing patterns. In preparation for data collection, RAs were trained on coding child looking behaviors using Peyecoder.

Our second research project examines how adverse childhood experiences, such as caregiver depression and anxiety, immigration status, and economic instability, impact child language development through caregiver-child interactions. We conducted a literature review on these variables which also examined the role of language interventions that promote dynamic interaction between child and caregiver. We used this literature review to revise a former student's thesis with the goal of publication by the end of the year.

Another crucial element of the lab development process was website design. Our website provides information for families, students, and researchers such as a sign-up page, publications, and RA opportunities. The research team used WordPress to create and edit the website, Photoshop to design the logo, and Canva for flyers and posters. Furthermore, the lab attended a virtual "mega meeting" with other developmental labs in the area where we presented our research.

Title of Abstract/Research

Developing the Little Lab at Smith College: Listen Up! and Parental Mental Health

Please type your abstract below.

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SURF Abstract Submission & Post Program Survey 2020

Name	Jiayun Chen
Year of Graduation	2023
SURF Advisor	Cristina Suarez Chemistry
Secondary SURF Advisor	Elizabeth Jamieson
SURF Field of Study	Biochemistry/Chemistry
Please list co-authors of your abstract (if applicable)	Michelle Chen

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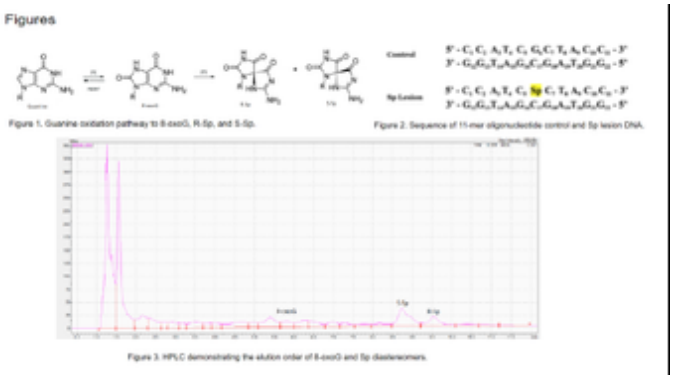

Title of Abstract/Research

The investigation of Spirominodiydantoin (Sp) Lesion in an 11-mer oligonucleotide

Please type your abstract below.

DNA is constantly being oxidized by reactive oxygen species (ROS) produced exogenously and endogenously that covalently modify its structure, which can lead to permanent mutations and cancer. Within DNA, guanine bases have the lowest reduction potential making them easily oxidized. When guanine is oxidized, 8-oxoguanine (8-oxoG) is produced and leads to G → T transversion mutations (Crenshaw et al., 2011). The 8-oxoG has an even lower reduction potential than G, therefore making 8-oxoG more likely to undergo further oxidation. The oxidation of 8-oxoG produces hyper-oxidized guanine lesions, such as the spirominodiydantoin (Sp) lesion. Unlike 8-oxoG, Sp contains a chiral carbon, which produces a pair of diastereomers that can be separated by High-Pressure Liquid Chromatography (HPLC) (Figure 1).

This summer, we re-started a research project that had been shut down because of COVID since March 2020. Carbonate radicals were used to oxidize 8-oxoG in an 11-mer oligonucleotide, and the products were purified with HPLC (Figure 2, 3). The purification procedure was optimized by minimizing the time spent on each run. The automation of HPLC utilizing the autosampler and fraction collector was investigated. The autosampler was used to inject samples of control DNA and the fraction collector was used to collect the signature peak of the control DNA. Due to the closeness of the two Sp lesion peaks, we are still trying to experiment using the fraction collector for Sp lesion purification. In the future, we plan to use Nuclear Magnetic Resonance (NMR) to perform a comparative study on the structural and kinetic effects of Sp diastereomers in an 11-mer DNA duplex.

References

Crenshaw, C., Wade, J., Arthanari, H., Frueh, D., Lane, B., and Nunez, M. Hidden in Plain Sight: Subtle Effects of the 8-oxoguanine Lesion on the Structure, Dynamics, and Thermodynamics of a 15-Base Pair Oligodeoxynucleotide Duplex. Biochemistry 2011, 50, 8463-8477.

SURF Abstract Submission & Post Program Survey 2020

Name	Elizabeth Campbell
Year of Graduation	2022
SURF Advisor	Brianna McMillan; Psychology
SURF Field of Study	Psychology
Please list co-authors of your abstract (if applicable)	Anna Maffa, Iliana Pliska-Bloch, Carmen Villalobos Guevara

Title of Abstract/Research Developing the Little Lab at Smith College: Listen Up!, Parental Mental Health, and More

Please type your abstract below.

Over the course of 10 weeks, Professor McMillan and her research assistants launched The Little Lab, a new cognitive development psychology lab. In addition to lab development, we focused on two projects specific to child language acquisition. The first project was a replication study of McMillan and Saffran, 2016 which we developed using MIT's online platform Lookit using JSON. This process involved collaboration not only amongst lab members but also with the Lookit community and administrators. The study, titled "Listen up! Learning words in background noise," investigates how 2- to 3-year-old English-speaking children learn novel words when there is background noise presented at different volumes. The original study found that when the background speech was only 5 db quieter than the target speech toddlers were less successful in learning the words. The goal of this replication is to continue the previous analysis and study the effect of background noise on parent-child interaction. This study uses the Looking-While-Listening procedure which assesses if a child has correctly learned the novel object based on gazing patterns. In preparation for data collection, RAs were trained on coding child looking behaviors using Peyecoder.

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SURF Abstract Submission & Post Program Survey 2020

Name	Katelyn Smalley
Year of Graduation	2022
SURF Advisor	Paulette Peckol; Biological Sciences
SURF Field of Study	Biological Sciences
Please list co-authors of your abstract (if applicable)	Michaela Guy, Catherine Park

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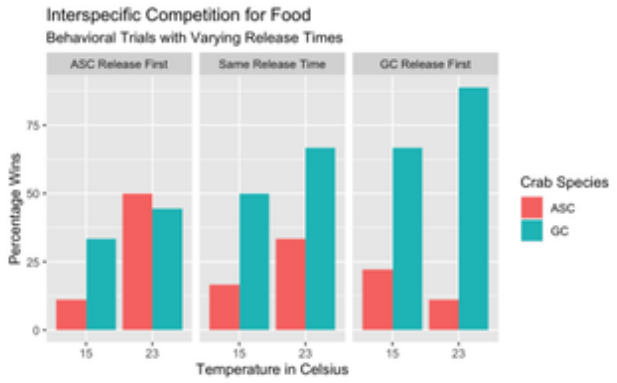

Figure 2: Percent of wins for food by Hemigrapsus sanguineus (Asian Shore Crab = ASC) and Carcinus maenas (Green Crab = GC) when held at two temperatures (15 and 23 degrees Celsius) and at different release times.

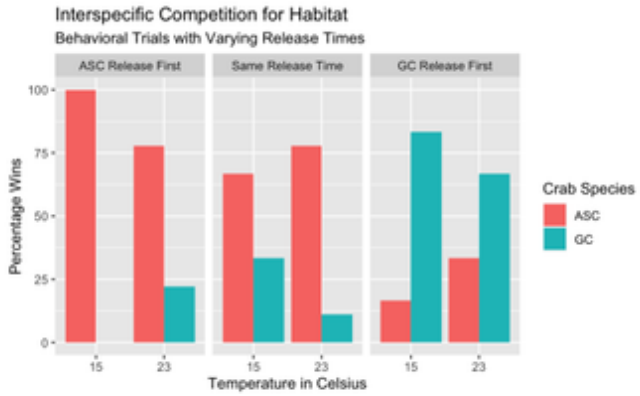

Figure 3: Percent of wins for habitat by Hemigrapsus sanguineus (Asian Shore Crab = ASC) and Carcinus maenas (Green Crab = GC) when held at two temperatures (15 and 23 degrees Celsius) and at different release times.

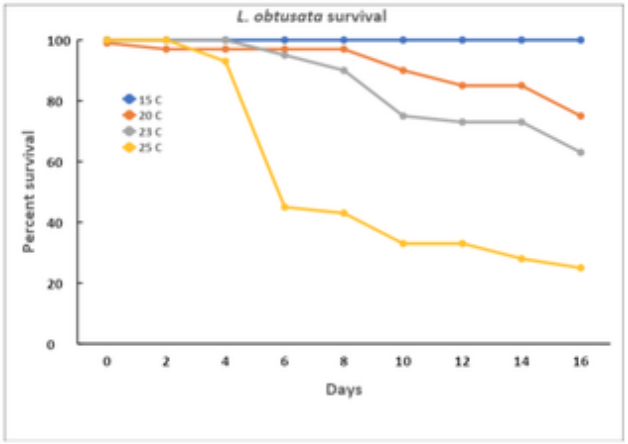

Figure 1: Percent survival of *L. obtusata* held at various temperatures.

Title of Abstract/Research

In the Hot Seat: Coping with Climate Change Along New England Rocky Shores

Please type your abstract below.

Competitive interactions can dramatically affect abundances, distribution, growth, and behavior of marine intertidal organisms. Two important grazers, Littorina littorea (introduced species) and L. obtusata (native species), show overlapping distributions, and abundances of the latter species are negatively affected by L. littorea (Putnam & Peckol 2018). Hemigrapsus sanguineus (Asian Shore Crab) and Carcinus maenas (European Green Crab) are invasive predator crab species that have spread along Atlantic shorelines. Notably, H. sanguineus has largely replaced C. maenas in southern New England intertidal areas. We investigated whether interspecific interactions of these dominant herbivore and predator species might be affected by warming temperatures associated with climate

change.
We studied the impact of warming temperatures on survival and growth rates of L. littorea and L. obtusata after acclimating the snails to experimental temperatures (15o, 20o, 23o, and 25oC). L. littorea may be more resilient to climate change as they had no mortality across experimental temperatures. In contrast, L. obtusata had >50% mortality within a week at 25°C, and somewhat reduced survivorship at 20o and 23oC (Fig. 1). Both grazers showed lowest growth rates and feeding at 25oC.
We also considered how interactions between invasive crab predators for habitat and food might be affected by warming temperatures. Preliminary feeding results suggested that C. maenas foraged more at lower temperatures while H. sanguineus were more active at higher temperatures. We constructed sand and rock habitats in aquaria, and observed behaviors at individual, intraspecific, and interspecific levels following acclimation at 15o, 20o, and 25oC. We studied a number of behaviors, including: initiating fights, contacting food, hiding in rock habitats, and burrowing. Results from these trials suggested that C. maenas tended to avoid interacting with H. sanguineus. We then documented interspecific interactions between the crab species for feeding and habitat use with staggered release times. For food trials, C. maenas always gained the food except when H. sanguineus were released first at higher temperatures (Fig. 2). In trials seeking habitat control, H. sanguineus won over C. maenas in all trials except when C. maenas were released first (Fig. 3). Under warming conditions along New England rocky shores, H. sanguineus may be more effective in claiming shelter for protection and foraging for food, making this species more resilient to climate change. Our work indicates that increasing water temperatures will likely have profound effects on abundances and distribution of these dominant grazers and predators over the next few decades.

(Supported by the Elizabeth B. Horner Fund, Choate Endowed Fund)
(Paulette Peckol, Biological Sciences)

SURF Abstract Submission & Post Program Survey 2020

Name	Catherine Park
Year of Graduation	2023
SURF Advisor	Paulette Peckol; Biological Sciences
SURF Field of Study	Biological Sciences
Please list co-authors of your abstract (if applicable)	Katelyn Smalley, Michaela Guy

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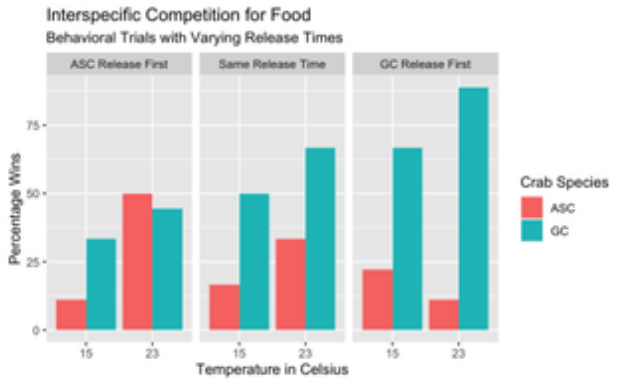

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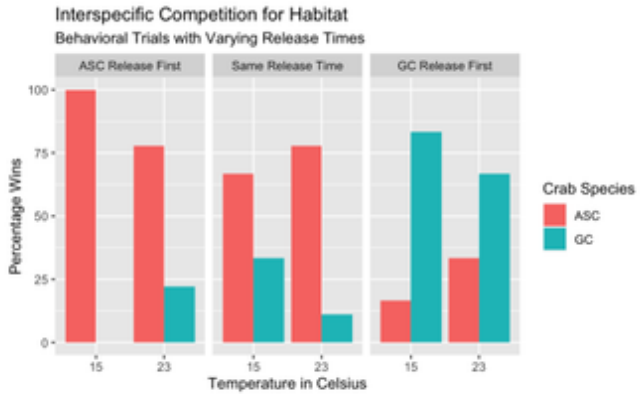

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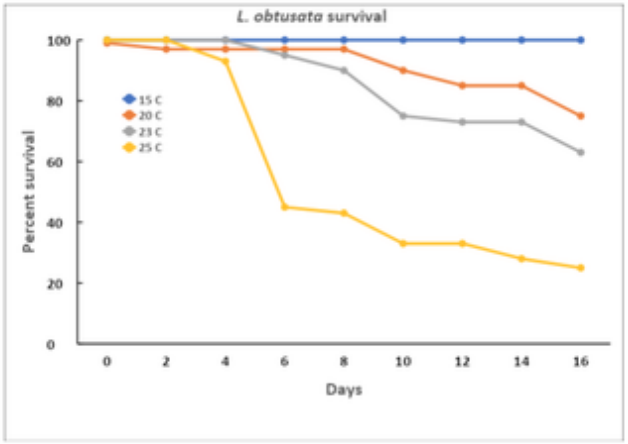

Figure 1: Percent survival of *L. obtusata* held at various temperatures.

Title of Abstract/Research

In the Hot Seat: Coping with Climate Change Along New England Rocky Shores

Please type your abstract below.

Competitive interactions can dramatically affect abundances, distribution, growth, and behavior of marine intertidal organisms. Two important grazers, Littorina littorea (introduced species) and L. obtusata (native species), show overlapping distributions, and abundances of the latter species are negatively affected by L. littorea (Putnam & Peckol 2018). Hemigrapsus sanguineus (Asian Shore Crab) and Carcinus maenas (European Green Crab) are invasive predator crab species that have spread along Atlantic shorelines. Notably, H. sanguineus has largely replaced C. maenas in southern New England intertidal areas. We investigated whether interspecific interactions of these dominant herbivore and predator species might be affected by warming temperatures associated with climate

change.

We studied the impact of warming temperatures on survival and growth rates of L. littorea and L. obtusata after acclimating the snails to experimental temperatures (15o, 20o, 23o, and 25oC). L. littorea may be more resilient to climate change as they had no mortality across experimental temperatures. In contrast, L. obtusata had >50% mortality within a week at 25°C, and somewhat reduced survivorship at 20o and 23oC (Fig. 1). Both grazers showed lowest growth rates and feeding at 25oC.

We also considered how interactions between invasive crab predators for habitat and food might be affected by warming temperatures. Preliminary feeding results suggested that C. maenas foraged more at lower temperatures while H. sanguineus were more active at higher temperatures. We constructed sand and rock habitats in aquaria, and observed behaviors at individual, intraspecific, and interspecific levels following acclimation at 15o, 20o, and 25oC. We studied a number of behaviors, including: initiating fights, contacting food, hiding in rock habitats, and burrowing. Results from these trials suggested that C. maenas tended to avoid interacting with H. sanguineus. We then documented interspecific interactions between the crab species for feeding and habitat use with staggered release times. For food trials, C. maenas always gained the food except when H. sanguineus were released first at higher temperatures (Fig. 2). In trials seeking habitat control, H. sanguineus won over C. maenas in all trials except when C. maenas were released first (Fig. 3). Under warming conditions along New England rocky shores, H. sanguineus may be more effective in claiming shelter for protection and foraging for food, making this species more resilient to climate change. Our work indicates that increasing water temperatures will likely have profound effects on abundances and distribution of these dominant grazers and predators over the next few decades.

(Supported by the Elizabeth B. Horner Fund, Choate Endowed Fund)
(Paulette Peckol, Biological Sciences)

SURF Abstract Submission & Post Program Survey 2020

Name Michaela Guy

Year of Graduation 2022

SURF Advisor Paulette Peckol; Biological Sciences

SURF Field of Study Biological Sciences

Abstract of Research Results
As part of the terms of your summer stipend, it is required that you submit an abstract with your research results, not to exceed 400 words and include a picture/diagram whenpossible. We will ask you to resubmit your abstract if it exceeds 400 words. Approval of your abstract by your advisor is required prior to submission. No edits will be made to your abstract after you submit it here.
Certainly we understand that with the range of projects and durations while doing this remotely, some may be more of a brief project description rather than a formal abstract. This is completely acceptable.

You can find sample abstracts from previous years here.

Please list co-authors of your abstract (if applicable) Katelyn Smalley, Catherine Park

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

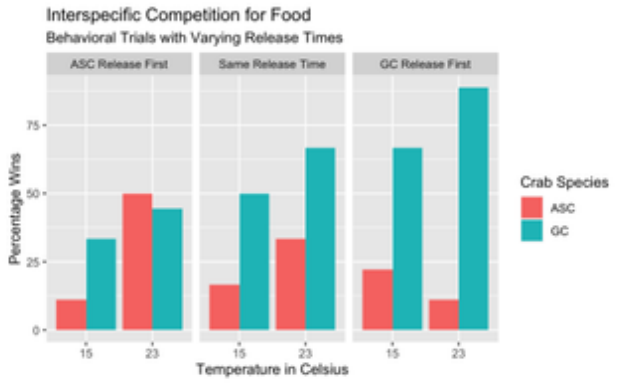

Figure 2: Percent of wins for food by Hemigrapsus sanguineus (Asian Shore Crab = ASC) and Carcinus maenas (Green Crab = GC) when held at two temperatures (15 and 23 degrees Celsius) and at different release times.

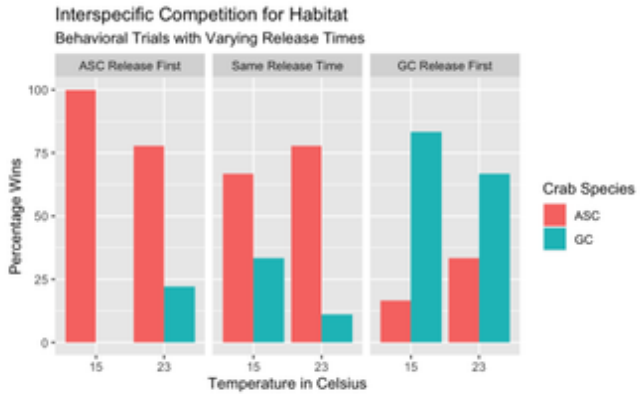

Figure 3: Percent of wins for habitat by Hemigrapsus sanguineus (Asian Shore Crab = ASC) and Carcinus maenas (Green Crab = GC) when held at two temperatures (15 and 23 degrees Celsius) and at different release times.

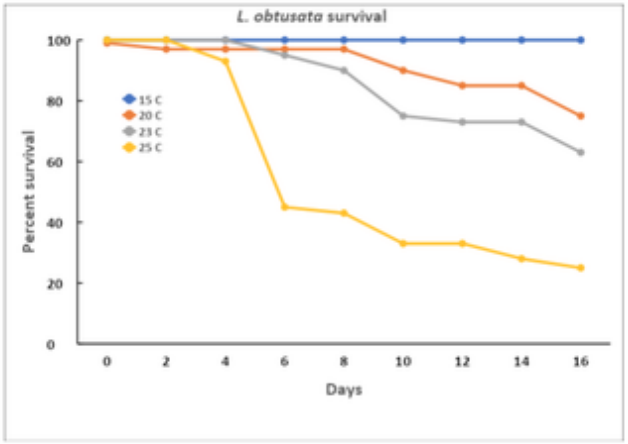

Figure 1: Percent survival of *L. obtusata* held at various temperatures.

Title of Abstract/Research

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(Supported by the Elizabeth B. Horner Fund, Choate Endowed Fund)
(Paulette Peckol, Biological Sciences)

SURF Abstract Submission & Post Program Survey 2020

Name	Pham Dan Anh Nguyen
Year of Graduation	2022
SURF Advisor	Geremias Polanco; Mathematics and Statistics
SURF Field of Study	Mathematics
Please list co-authors of your abstract (if applicable)	Kathia Masimbi Natete

Title of Abstract/Research A special sequence relating to Sturmian sequence

Please type your abstract below.

In our SURF 2021 research experience we studied a discrete dynamical system with a countably infinite number of discontinuities, focusing on the number theoretic properties of special orbits. This system is generated by a function that gives Sturmian sequences if seeded with an irrational number. The special orbits we are interested in come from an infinite family of rational numbers. We showed that the orbits of an element of the sequence contains the orbits generated by smaller numbers in the family. Moreover, all the orbits in the family stabilize at 1 and have symmetry. Furthermore, these orbits seem to have both fractal-like structure, and quasi-periodicity. In the process, we found interesting connections with continued fractions, Euler numbers, and the special linear group $\mathbf{SL}_2(\mathbb{Z})$.

SURF Abstract Submission & Post Program Survey 2020

Name	Amy Hagen
Year of Graduation	2022
SURF Advisor	Sara Pruss; Geosciences
SURF Field of Study	Geosciences
Title of Abstract/Research	Wrapping up work on the SPICE event in western Newfoundland

Please type your abstract below.

This summer, my SURF research with Prof Sara Pruss involved preparing a manuscript for publication as well as sampling and processing rocks from Maryland for a new project. I compiled the important information from my honors thesis into a manuscript draft which is in the process of being sent away for editing by our coauthors. The paper describes how the Steptoean Positive Isotopic Carbon Excursion (SPICE event) manifests in strata from Newfoundland and investigates whether or not sedimentary mercury concentrations surrounding the excursion may be connected to marine redox fluctuations (Pruss et al., 2019). We support recent emphasis on the local variability of the SPICE (i.e. Pulsipher et al., 2021) and describe the complexities of trying to use mercury as a redox proxy. This writing work has also prepared me for a presentation at the Geological Society of America conference this fall, where I will update the scientific community on our work and hopefully encourage readership of our paper.

As well as working on writing this summer, I also helped with sampling rocks from Maryland, which will create future projects in Sara's lab. We aimed to sample a previously undocumented SPICE section, but are still unclear if we found the full excursion or not. The carbon isotope excursion that we found is very low in magnitude, suggesting that we perhaps have a different excursion altogether or that the SPICE is truncated by an unconformity. Regardless, we identified a nearly continuous section spanning hundreds of meters from the Cambrian to Ordovician periods which has the potential to create numerous new projects. I helped collect initial data by analyzing samples for carbon isotopes and mercury concentrations and preparing billets for thin sections.

Refs:

Pruss, S.B., Jones, D.S., Fike, D.A., Tosca, N.J., and Wignall, P.B., 2019. Marine anoxia and sedimentary mercury enrichments during the Late Cambrian SPICE event in northern Scotland, Geology.

Pulsipher, M.A., Schiffbauer, J.D., Jeffrey, M.J., Huntley, J.W., Fike, D.A., and Shelton, K.L., 2021. A meta-analysis of the Steptoean Positive Carbon Isotope Excursion: The SPICEraq database, Earth-Science Reviews, v. 212, p. 1-23.

SURF Abstract Submission & Post Program Survey 2020

Name	Aniya Moise
Year of Graduation	2022
SURF Advisor	Albert Kim; Statistical and Data Sciences
SURF Field of Study	Data Science
Title of Abstract/Research	Spatial Epi R Package

Please type your abstract below.

Spatial Epi is a R package of methods and data for spatial epidemiology Professor Kim developed this package over 10 years ago for his graduate school dissertation and until recently the package still has 1000+ downloads per month. Since Professor Kim developed Spatial Epi some of the technology and methods used to develop it are outdated. This summer we used a method called “Code Refactoring" while working on the Spatial Epi Package. Code refactoring is the process in which existing source code is adjusted without changing its original functionality. I refactored functions and their documentations that used outdated packages. I also converted all spatial data objects to the sf package. Once all of the code refactorings were complete I began updating the manuscript with the new functions based on a previous, outdated document and new PeerJ Journal skeleton for submission. In the end, I enjoyed working with Professor Kim. I was able to improve my R programming and git version control skills which will be useful in the future.

SURF Abstract Submission & Post Program Survey 2020

Name	Kathia Masimbi Natete
Year of Graduation	2023
SURF Advisor	Geremias Polanco; Mathematics and Statistics
SURF Field of Study	Mathematics: Number Theory
Please list co-authors of your abstract (if applicable)	Anh Nguyen

Title of Abstract/Research Mersenne Involution

Please type your abstract below.

In our SURF 2021 research experience, we studied a discrete dynamical system with a countably infinite number of discontinuities, focusing on the number-theoretic properties of special orbits. This system is generated by a function that gives Sturmian sequences if seeded with an irrational number. The special orbits we are interested in come from an infinite family of rational numbers. We showed that the orbits of an element of the sequence contain the orbits generated by smaller numbers in the family. Moreover, all the orbits in the family stabilize at 1 and have symmetry. Furthermore, these orbits seem to have both fractal-like structures, and quasi-periodicity. In the process, we found interesting connections with continued fractions, Euler numbers, and the special lineargroup SL2(Z).

SURF Abstract Submission & Post Program Survey 2020

Name	Laura Bickart
Year of Graduation	2023
SURF Advisor	David Gorin; Chemistry
SURF Field of Study	Chemistry

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

Title of Abstract/Research DNA Coupled Small Molecule Catalysts

Please type your abstract below.

Carrying out complex chemical reactions in a biological system presents a number of difficulties, one of which being site selectivity, which is the ability to react with one functional group when there are multiple of that same group present. It is for this reason that the Gorin lab has been working on synthesizing DNA Coupled Small Molecule Catalysts (DCats). DCat chemistry requires three components: a DNA aptamer, a catalyst, and a substrate. The DNA and catalyst attach to each other and act similarly to a naturally occurring enzyme; the enzyme binding to the substrate portion of the DCat and allowing for a chemical transformation to take place. Previous work on this project has shown that a DNA tethered catalyst can increase the rate of ester hydrolysis by approximately 100- fold compared to its untethered counterpart. This method has also been shown to be effective on a number of different esters containing substrates.

My work this summer has focused on synthesizing a new substrate for a DCat to act upon. This work consisted of the synthesis of an ether via a Mitsunobu or SN2 reaction, a variety of ester hydrolysis reactions, and Curtius rearrangements. I was able to successfully synthesize the ether using both sets of conditions. The ester hydrolysis was successfully completed using NAOH, methanol, and dichloromethane. Attempts at a Curtius reaction on my substrate have been unsuccessful thus far. Further work needs to be done with the ester hydrolysis to make sure it is replicable, and obtain material for a Curtius reaction. I will also be working on a similar set of reactions, with the addition of cholic acid so that a DNA aptamer can be attached to the molecule.

SURF Abstract Submission & Post Program Survey 2020

Name	Iliana Pliska-Bloch
Year of Graduation	2023
SURF Advisor	Brianna McMillan; Psychology
SURF Field of Study	developmental psychology
Please list co-authors of your abstract (if applicable)	Anna Maffa, Beth Campbell, Carmen Villalobos Guevara

Title of Abstract/Research Developing the Little Lab at Smith College: Listen Up!, Parental Mental Health, and More

Please type your abstract below.

Over the course of 10 weeks, Professor McMillan and her research assistants launched The Little Lab, a new cognitive development psychology lab. In addition to lab development, we focused on two projects specific to child language acquisition. The first project was a replication study of McMillan and Saffran, 2016 which we developed using MIT's online platform Lookit using JSON. This process involved collaboration not only amongst lab members but also with the Lookit community and administrators. The study, titled "Listen up! Learning words in background noise," investigates how 2- to 3-year-old English-speaking children learn novel words when there is background noise presented at different volumes. The original study found that when the background speech was only 5 db quieter than the target speech toddlers were less successful in learning the words. The goal of this replication is to continue the previous analysis and study the effect of background noise on parent-child interaction. This study uses the Looking-While-Listening procedure which assesses if a child has correctly learned the novel object based on gazing patterns. In preparation for data collection, RAs were trained on coding child looking behaviors using Peyecoder.

Our second research project examines how adverse childhood experiences, such as caregiver depression and anxiety, immigration status, and economic instability, impact child language development through caregiver-child interactions. We conducted a literature review on these variables which also examined the role of language interventions that promote dynamic interaction between child and caregiver. We used this literature review to revise a former student's thesis with the goal of publication by the end of the year.

Another crucial element of the lab development process was website design. Our website provides information for families, students, and researchers such as a sign-up page, publications, and RA opportunities. The research team used WordPress to create and edit the website, Photoshop to design the logo, and Canva for flyers and posters. Furthermore, the lab attended a virtual "mega meeting" with other developmental labs in the area where we presented our research.

SURF Abstract Submission & Post Program Survey 2020

Name	Ruth Penberthy
Year of Graduation	2022
SURF Advisor	Niveen Ismail; Engineering
SURF Field of Study	Engineering

Please list co-authors of your abstract (if applicable)

Sarah Miller

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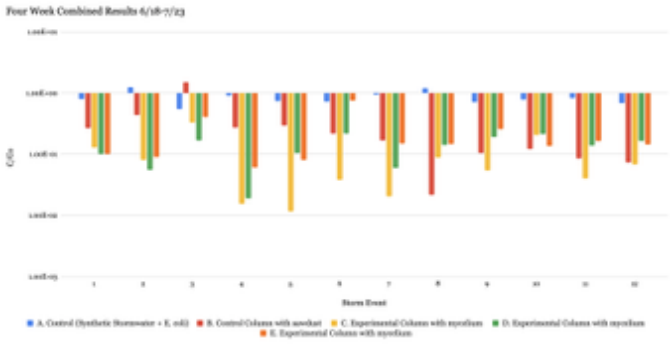

Title of Abstract/Research

Application of Mycoremediation to Reduce Escherichia coli in Runoff

Please type your abstract below.

The degradation of clean freshwater sources due to microbial pollutants has adverse effects on human health and the environment. Best Management Practices (BMPs) are engineered pollution-control systems that supplement traditional water treatment methods with alternate filtrative, vegetative and structural practices. A potential addition to bioretention basins, a type of BMP, is fungal mycelium that operates as a biologically active filter. Mycelium is the vegetative body of fungi and is known to secrete antibacterial enzymes. Previous research has indicated through permeability and resiliency testing that Pleurotus ostreatus could potentially inactivate Escherichia coli present in contaminated water. This research provides a systematic approach to determining and testing conditions to increase E. coli inactivation using mycelium. Experiments were conducted using E.coli K-12 and Pleurotus ostreatus fungal mycelium inoculated on sawdust. EPA method 1602 was used to quantify E. coli colonies in the samples taken at set time-points throughout the experiment. Through the experimentation process we assessed the capacity of used fungal mycelium blocks to remove the microbial pollutant (E. coli) from water during simulated storm events over time. The storm events were clustered in 2-4 days with drying periods of 5-8 days in between to investigate the capabilities of the packed fungal mycelium columns in long term usage. For storm events 1 through 7, we observed approximately 1 log removal of E. coli by the columns containing mycelium. However, in the remainder of the storm events, the mycelium columns did not remove more E. coli than the control column that contained sawdust, soil, and sand. These results demonstrate that the columns were inconsistent over time, sometimes removing up to 2 log C/Co while others having less than 1 log removal. This leads us to reflect upon the conditions of the columns, particularly in the increase of performance in the control column which was highly unexpected. It appeared that any mycelium growth that occurred happened in the first 3 storm events, and there was little to no additional mycelium growth after that. The conditions in mycelium columns were not conducive to mycelium growth which we hypothesize impacted the performance of the mycelium columns over time. Furthermore, we hypothesize that the sawdust in the control column may have become contaminated in the duration of the experiment, leading to the increase in removal.

SURF Abstract Submission & Post Program Survey 2020

Name	Juliet Ramey-Lariviere
Year of Graduation	2022
SURF Advisor	Sara Pruss; Geosciences
SURF Field of Study	Environmental Geoscience
Title of Abstract/Research	Evidence for biologically influenced precipitation in ooids from Shark Bay, Western Australia

Please type your abstract below.

The goal of my SURF project with Professor Sara Pruss was to synthesize our data and research from my spring 2021 special studies project. We have been researching ooids that were collected from Shark Bay, Western Australia in 2017. Ooids are typically small (<1 mm in diameter) rounded carbonate grains that form in warm agitated water. Most ooids form through a cycle of precipitation of a mineral, often calcium carbonate, followed by abrasion. However, there remains an open debate over the involvement of microbes in ooid formation. The samples were collected from ooid-containing subtidal sand near Carbla beach in Shark Bay, Western Australia to constrain the microbial contribution to ooid formation at this locality. Shark Bay ooids abundant in the >180 μm size fraction show distinct organic-rich nuclei that contain iron sulfide. The nuclei are surrounded by 5-10 μm-thick inner cortices composed of high-magnesium calcite and multiple aragonitic outer layers (25-50 μm). The presence of a single layer of high-magnesium calcite in close association with iron sulfide and organic-rich nuclei suggests that microbial sulfate reduction facilitated precipitation of both iron sulfide minerals and that the degrading organic compounds helped nucleate and stabilize high-magnesium calcite. The aragonitic outer layers likely precipitated in equilibrium with the surrounding water. This spatial distribution of iron sulfide minerals with high-magnesium calcite in ooids from Shark Bay is a textural biosignature of the microbial influence on the nucleation and initial formation of ooid cortices.

SURF Abstract Submission & Post Program Survey 2020

Name	Caroline Ruppert
Year of Graduation	2024
SURF Advisor	Sarah Mazza; Geosciences
SURF Field of Study	Geosciences
Title of Abstract/Research	Gathering Information for a Geochemistry Report on Bermuda

Please type your abstract below.

It was recently theorized that Bermuda was formed via unconventional intraplate volcanism. The process is hypothesized to be the result of a piece of crust associated with the supercontinent Pangea being stored in the mid-mantle, creating a pocket of volatile-rich magma. That pocket then erupts from the mantle into the crust to form the volcanic pedestal that is Bermuda (Mazza et al., 2019).
My SURF experience this summer was to prepare samples to help compile information for the geochemistry report on the volcano, using the new samples from the same core that Mazza et al. (2019) studied. The process involved cutting the core samples into billets for thin section preparation, crushing the remaining sample into gravel, sorting the gravel into sizes smaller and larger than 2 millimeters, picking through the <2mm gravel to pick out secondary minerals like calcite, epidote, and pyrite as well as isolating large clinopyroxene and biotite minerals for further study, and milling the sorted gravel into a fine powder. The final result was a powder that was taken to the University of Massachusetts , oxidized, and melted with flux into a glass disk to be analyzed for major element concentration using X-Ray Fluorescence (XRF). The major element geochemistry obtained from these samples will be integrated into the ongoing study of Bermuda's volcanic past.

Source

Mazza S.E., Gazel E., Bizimis M. et al. 2019, Sampling the volatile-rich transition zone beneath Bermuda. Nature. 569, 398–403.

SURF Abstract Submission & Post Program Survey 2020

Name	Caroline Davock
Year of Graduation	2023
SURF Advisor	Bosiljka Glumac; Geosciences
SURF Field of Study	Geosciences
Title of Abstract/Research	The Development of the “Climate in Arts and History” Website: An Educational Resource Aimed at Promoting Climate Literacy Across Disciplines

Please type your abstract below.

The “Climate in Arts and History” website (http://www.science.smith.edu/climatelit/) strives to promote climate literacy beyond the natural and environmental sciences by highlighting the impact of climate on society and culture. To achieve this goal, specific historical events, works of art, literature and music, and other aspects of human life are connected to climate changes in Earth’s history and their relationships are explained. As the effects of anthropogenic climate change are becoming more visible, comprehensive climate education is needed to engage the general public and build collective resilience in the next generation.

The first stage of this project involved developing at least one entry in each of the five sections of the website: art, history and social studies, languages, literature and music. Therefore, most of the work completed this summer focused on researching, writing and posting entries on individual climate-related topics in these subject areas. Each entry consists of a brief description of the topic, an exploration of its connection to climate and links to additional resources. Examples of recently-developed topics include: A Future Under Climate Tyranny (A 4°C Warmer World) (2011) by Maggie Puckett (Art), The Dust Bowl (History), An Introduction to the Word Climate (Languages), The Grapes of Wrath (1939) by John Steinbeck (Literature) and A Passion for the Planet by Geoffrey Hudson (Music). Entry development also includes contacting artists whose work we feature and other content area experts for their feedback.

This resource was originally intended for K-12 teachers, so some work has been geared toward its educational component. Specifically, this summer we presented at the Mid-Atlantic Climate Change Education Conference to advertise the website and seek feedback from climate and education professionals. I also went through the Massachusetts Learning Standards to find topics with a connection to climate. This enabled me to target my research and prioritize developing entries for topics already taught in K-12 classrooms, making the resource as useful as possible for teachers.

Other work has included writing an abstract and preparing a poster for presentation at the Geological Society of America Meeting in Portland, Oregon in October 2021. Future work will include collaborating directly with teachers and other education professionals to more closely align the content with educational standards and develop activities for incorporating the content into non-STEM courses. We will also continue to raise awareness for and update the website as we obtain new information and receive feedback.

SURF Abstract Submission & Post Program Survey 2020

Name	Angela Chavez
Year of Graduation	2023
SURF Advisor	David Gorin; Chemistry
SURF Field of Study	Chemistry

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

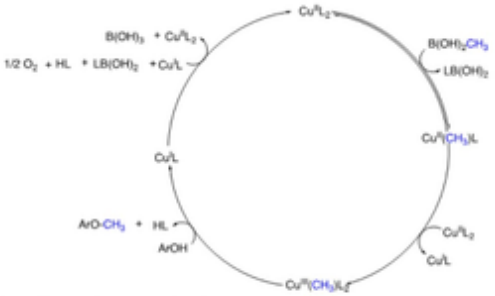

Figure 1: General Chan-Evans-Lam mechanism

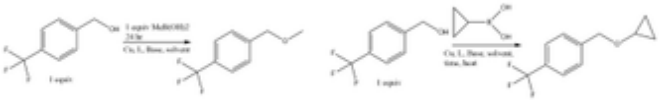

Figure 2: general reaction scheme for aliphatic alcohol methylation and cyclopropylation

Title of Abstract/Research

Oxygen methylation via Oxidative cross coupling and Chan-Evans-Lam mechainsm

Please type your abstract below.

Aryl methyl ether moieties are common within medicinal chemistry, agrochemistry, and natural products. In order to synthesize these compounds, toxic and unstable electrophiles such as diazomethane, dimethylsulfate and methyl iodide are needed. Therefore there is a need to be able to do these reactions using non-hazardous reagents. The Gorin lab has been able to do this, by eliminating electrophiles for the entire process. We do this using oxidative cross coupling via the Chan-Evans-Lam mechanism and methylboronic acid. This type of mechanism is well explored using arylboronic acid but the corresponding oxygen methylation is less developed.

This summer, we finished up getting NMR data for a paper we are trying to publish on phenol methylation. This data is important because it proves we made the molecules we claim to have synthesized. This process included rerunning reactions, work ups, Thin Layer chromatography and flash column chromatography.

Once we finished up that data collection, we turned to a new project. There is little research done on aliphatic alcohol oxidative cross coupling, so we are extending our knowledge of the Chan-Evans-Lam methylation mechanism to this. We have not been successful with our reactions yet, but during this research, we have also learned that cyclopropylation and benzylation of aliphatic alcohols have not been explored either. Therefore, we have lots of new directions to move forward.

SURF Abstract Submission & Post Program Survey 2020

Name	Carmen Villalobos
Year of Graduation	2022
SURF Advisor	Brianna McMillan; Psychology
SURF Field of Study	psychology
Please list co-authors of your abstract (if applicable)	Anna Maffa, Beth Campbell, Iliana Pliska-Bloch

Title of Abstract/Research Developing the Little Lab at Smith College: Listen Up!, Parental Mental Health, and More

Please type your abstract below.

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SURF Abstract Submission & Post Program Survey 2020

Name	Catherine Kung
Year of Graduation	2022
SURF Advisor	Alicia Grubb; Computer Science
SURF Field of Study	Computer Science
Please list co-authors of your abstract (if applicable)	Manar Alnazer, Yesugen Baatartogtokh, Angela Chu, Irene Foster

Title of Abstract/Research Frontend Refactor of BloomingLeaf to Backbone.js

Please type your abstract below.

BloomingLeaf is an analysis and modeling tool that allows users to model goals that evolve over time. These models consist of intentions, actors, and links. By evaluating the changes in intentions over time, users are better able to understand future project evolutions. BloomingLeaf has been developed incrementally over several years as new features were required to explore research questions. As such, the code contained multiple global variables and was highly coupled. For example, if a developer wanted to update one of the elements, they would have to look through the code for all of the places it was mentioned and update it in every spot. Recently, while exploring new model management features, we discovered that the code base could be significantly improved by taking full advantage of Backbone.js.

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SURF Abstract Submission & Post Program Survey 2020

Name	Angela Chu
Year of Graduation	2023
SURF Advisor	Alicia Grubb; Computer Science
SURF Field of Study	Computer Science
Please list co-authors of your abstract (if applicable)	Manar Alnazer, Yesugen Baatartogtokh, Irene Foster, Catherine Kung

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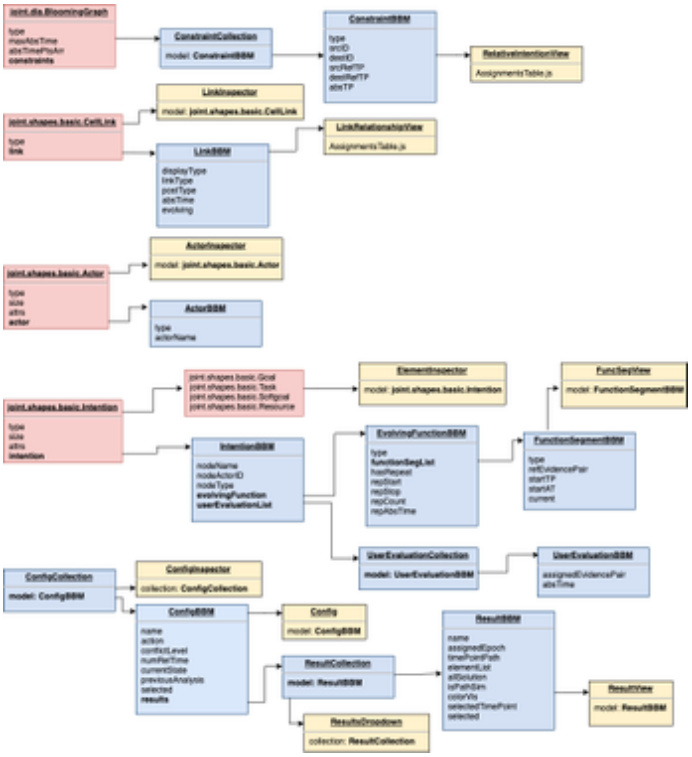

Title of Abstract/Research

Frontend Refactor of BloomingLeaf to Backbone.js

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SURF Abstract Submission & Post Program Survey 2020

Name	Yesugen Baatartogtokh
Year of Graduation	2023
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SURF Field of Study	Computer Science
Please list co-authors of your abstract (if applicable)	Manar Alnazer, Angela Chu, Irene Foster, Catherine Kung, Alicia Grubb

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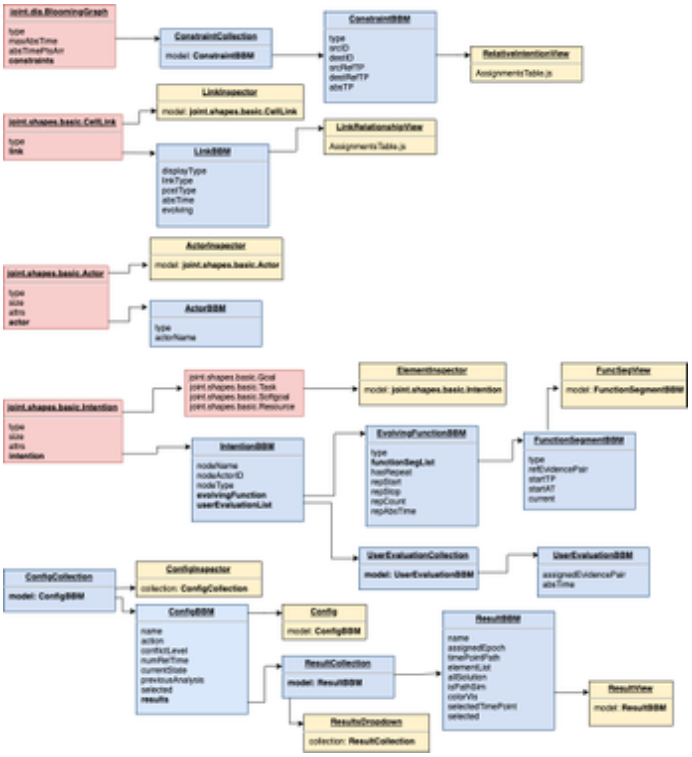

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SURF Abstract Submission & Post Program Survey 2020

Name	Irene Foster
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SURF Field of Study	Computer Science
Please list co-authors of your abstract (if applicable)	Manar Alnazer, Yesugen Baatartogtokh, Angela Chu, Irene Foster, Catherine Kung, Alicia Grubb

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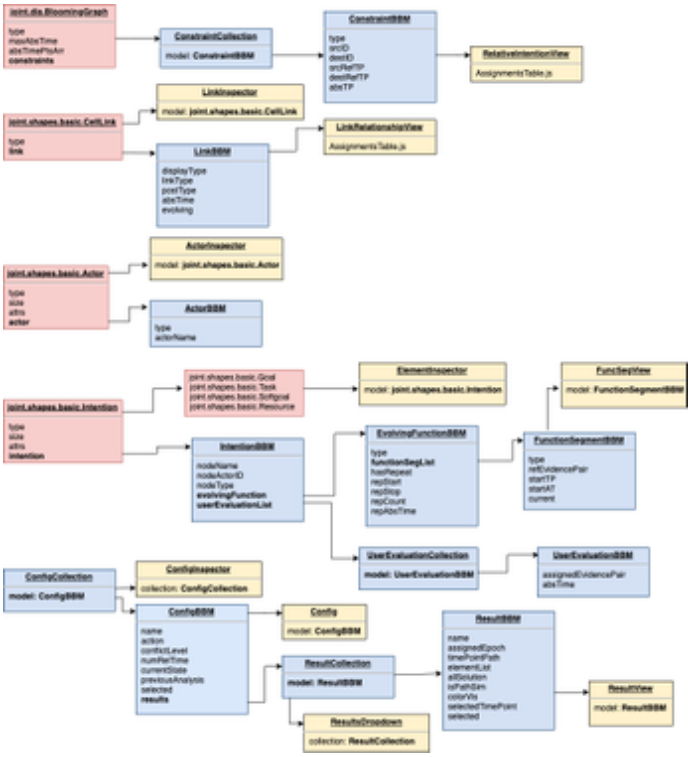

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Name	Manar Alnazer
Year of Graduation	2024
SURF Advisor	Alicia Grubb; Computer Science
SURF Field of Study	Computer Science
Please list co-authors of your abstract (if applicable)	Angela Chu, Yesugen Baatartogtokh, Irene Foster, Catherine Kung

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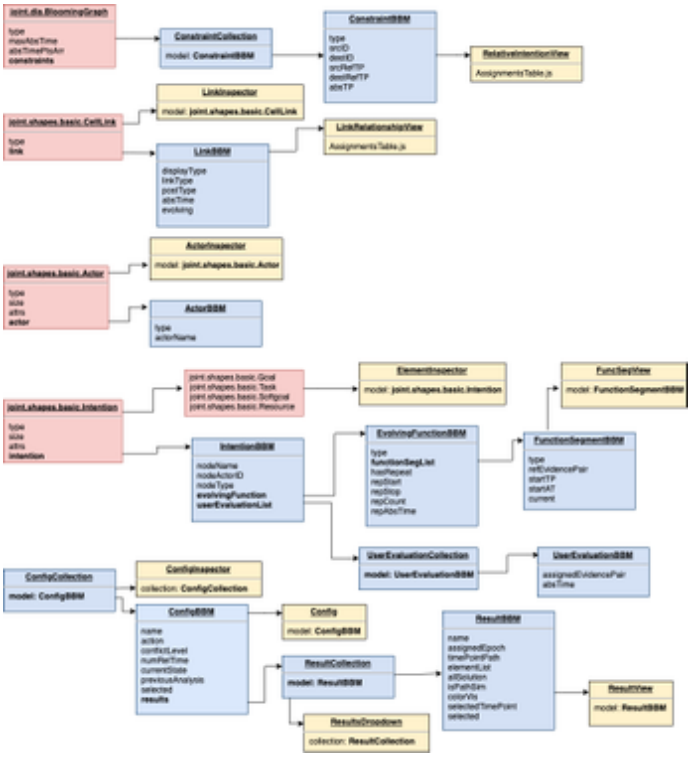

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SURF Abstract Submission & Post Program Survey 2020

Name	Lauren Light
Year of Graduation	2023
SURF Advisor	James Lowenthal; Astronomy
SURF Field of Study	Astronomy

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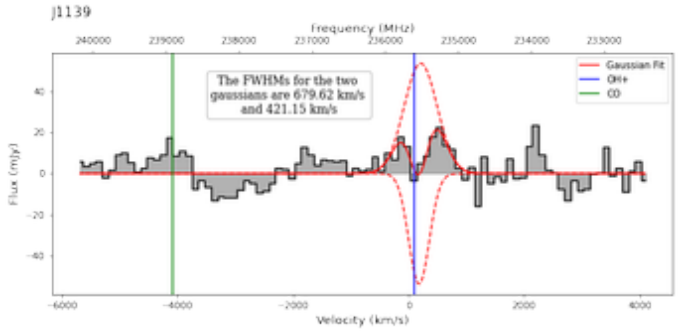

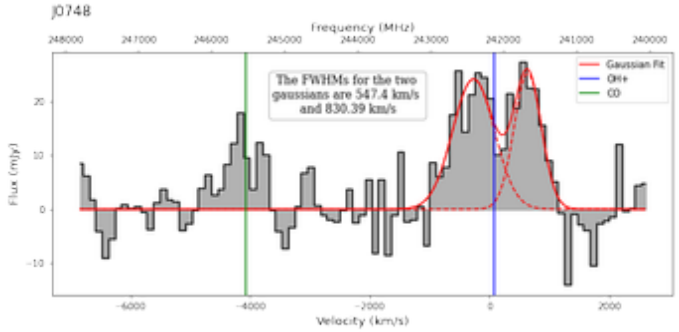

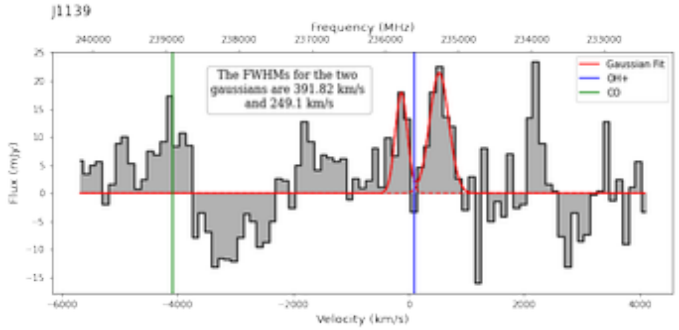

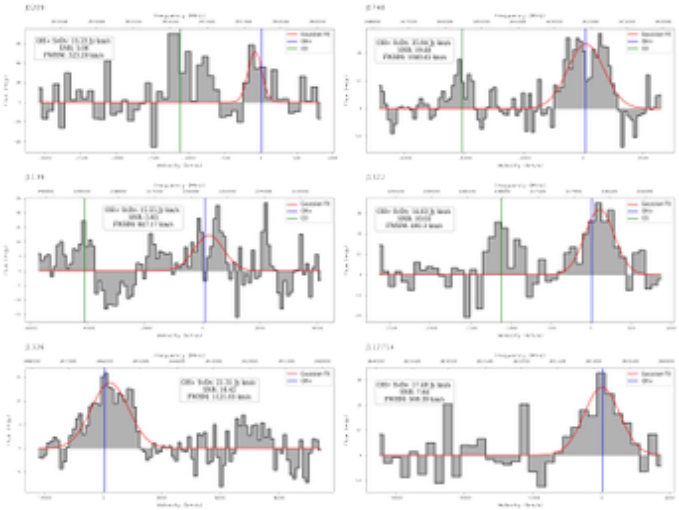

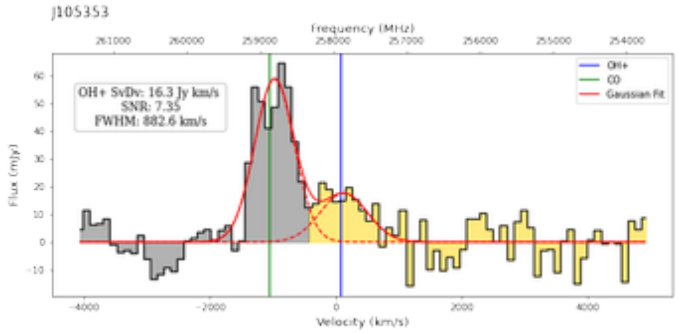

Title of Abstract/Research Hydride Lines in Gravitationally Lensed Dusty Star-Forming Galaxies

Please type your abstract below.

I present 7 detections of the hydride ion OH+ in the APEX and IRAM 30m spectra of 22 dusty star-forming galaxies (DSFGs), extremely luminous galaxies in the early universe (redshift z = 1-3). The Planck All-Sky Survey to Analyze Gravitationally lensed Extreme Starbursts (PASSAGES) team selected DSFG candidates by cross referencing the Planck and Herschel catalogs, and selecting for the brightest Planck objects at sub-mm wavelengths. These sources were found to be gravitationally lensed, accounting partly for their extreme brightness, however they also have star formation rates several orders of magnitude in excess of the most active local galaxies.

I searched the spectra for hydrides, tracers of diffuse gas distinct from the cold, dense gas that forms stars. Hydride ions are tracers of ionizing radiation and play a critical role in many astrochemical processes. Out of roughly 85 candidate hydride detections, 7 were detected with a signal to noise ratio (SNR) greater than 5σ, all of them OH+. Many of the lines were unusually broad with a median full width at half maximum (FWHM) of 883 km/s, nearly twice as broad as the CO lines in the hydride non-detections, at 430 km/s. This width, if not an artifact or the combined emission from several species, indicates a large velocity dispersion in the starburst galaxy. Two of the widest lines had distinctly bimodal shapes, perhaps indicative of a merging system or self absorption by a cold cloud of gas surrounding the galaxy. The spectral characteristics of my detections of the OH+ ion indicate that there is much to learn about the physical processes underlying the creation and evolution of these extreme starbursts that cannot be seen in more common astrochemical molecules.

SURF Abstract Submission & Post Program Survey 2020

Name	Hannah Gong
Year of Graduation	2024
SURF Advisor	Patricia Cahn; Mathematics and Statistics
SURF Field of Study	P-Colorability of Surfaces Bounded by Knots
Please list co-authors of your abstract (if applicable)	Kate Bernklau Halvor, Annika Gonzelez-Zugasti

Title of Abstract/Research p-Colorability and Knot Theory

Please type your abstract below.

A knot in mathematics is similar to a knot in real life. Imagine that you take a piece of string and tangle it up. Then, glue the two ends of the string together. When we draw a knot on paper, we draw a diagram with over-under crossing information. However, there are a couple more rules to these theoretical knots. A knot is an embedding of the circle in 3D space. An embedding simply means that the circle does not touch itself anywhere.

Knots are categorized by their crossing number, which is the least number of crossings that a knot has in any diagram of the knot. For example, if a diagram of a knot has 5 crossings, but can actually be deformed to only have 3 crossings, but not fewer, then that knot has 3 crossings. In order to deform a knot, we use the three Reidemeister moves to assure that our knot does not pass through itself while being deformed, because that would result in a completely different knot.

There are knot invariants which are numbers that can be used to tell different knots apart. The crossing number is not an invariant because there are multiple knots for many of the crossing numbers. One of the most important invariants for our purposes is the 3-coloring and, by extension, the p-coloring. The 3-coloring assigns 3 different colors to a knot, using the following rules: each arc (meaning if you follow a strand of the knot, the arc will end at a crossing where that strand is under) is assigned a color, at each crossing the 3 strands either have to be all the same color or three different colors, and at least 2 of the colors must be used in the entire diagram. If the determinant is divisible by 3, then it is 3-colorable. The p-coloring is a similar invariant where the “3” is replaced by any prime number p. However, for the p-coloring, at each crossing, the sum of the two bottom strands must be equivalent to twice the upper strand mod p.

We studied surfaces bounded by knots, where the surface lies in the 4th dimension. The 4-genus of the knot is the minimum number of holes in any such surface. These surfaces are defined by the amount of births, deaths, and saddles they have, which can be used to compute the 4-genus. A p-coloring of the knot will extend over the surface when the saddle moves can be applied using only strands that share the same color. We then explored for which knots the minimal 4-genus and the minimal p-colored 4-genus are the same.

SURF Abstract Submission & Post Program Survey 2020

Name	Julia Frothingham
Year of Graduation	2023
SURF Advisor	Nat Fortune; Physics
SURF Field of Study	Physics
Title of Abstract/Research	A Circuit Board Printer for Muon Detector Construction and Classroom Use

Please type your abstract below.

Muons are charged particles resulting from cosmic rays traveling through the atmosphere at near lightspeed. Studying muons can shed light on Einstein's theory of relativity, dark matter, and other important areas of physics research. Over the last two years, students in Professor Fortune's lab at Smith College have built several muon detectors by hand and used them to collect data on muon flux at different elevations. I tested a slightly different process for building the detectors. Using reflow soldering, components are placed in solder paste on circuit boards and then heat is applied to the entire board, melting the paste to form a solder joint.

Specifically, I worked with a circuit board printer. It prints conductive ink as well as metallic solder paste, allowing for the easy construction of circuit boards in the lab from scratch. I revised files provided with the MIT Cosmic Watch portable muon detector design so that they are compatible with the circuit board printer. I was able to use the printer to solder small components onto several sets of muon detector circuit boards and assemble functional muon detectors. Previous construction of the muon detectors required that all components be individually hand-soldered. By using the printer, many small components can be soldered to a circuit board at once. This will benefit future students working with these muon detectors, as they will be able to construct detectors more efficiently and reliably. Using the printer also exposes students to reflow soldering processes and additive manufacturing techniques.

For this reason, there has been interest expressed in including the printer as part of the physics department's electronics course. It would add to the course's hands-on nature and allow students to actually create circuits designed in class. In addition to my main project using the printer to make muon detector circuitry, I designed and built a camera mount to attach a USB webcam to the printer. Adding a camera allows more engaging and accessible remote use of the printer and makes it easier to accurately align and calibrate before printing.

My work this summer showed that a circuit board printer can be used to successfully construct muon detectors and may also benefit the Smith College physics department curriculum. Further work could be done to test and characterize different functions of the printer and investigate whether additional steps in constructing the muon detectors can also be automated with printer use.

SURF Abstract Submission & Post Program Survey 2020

Name	Dominique Kelly
Year of Graduation	2022
SURF Advisor	Albert Kim; Statistical and Data Sciences
SURF Field of Study	Statistical Data Science
Title of Abstract/Research	MacLeish R Package

Please type your abstract below.

The macleish R Package was created by SDS Prof. Ben Baumer through R programming and GitHub for simple accessibility to weather, spatial, and photography data from the Ada & Archibald MacLeish Field Station. The macleish package allows individuals to connect with an interactive map of the MacLeish Field Station and the surrounding area, retrieve meteorological data from historical and current databases, observe data on tree diameter of different species infected by the Hemlock Woolly adelgid over time, and salvage from an image database of tree canopy over time. The package is intended to inspire interdisciplinary collaboration between SDS, biology, and other related disciplines within the Smith College community.

The main objective of the research was to update the macleish R package source code on GitHub and submit to CRAN, which is an archive network that hosts a collection of documentation on R repositories. Furthermore, I wrote a manuscript with the intention to submit to the Journal of Statistical Software. However, the paper may be submitted to a new journal instead due to a more attainable audience depending on what original package author Prof. Baumer thinks. After updating the source code, I focused on writing the draft for the research paper, including demo code and figures. I was successful in adding new data on tree diameter from Jesse Bellemare, compiling the contributions of related research from Paul Wetzel, and creating a draft of the paper. On the contrary, I wasn't able to define a function that would retrieve images from the PhenoCam Network, which is an ecosystem phenology camera network that provides automated, near-surface remote sensing of canopy from the MacLeish Field Station. Professors Kim & Baumer are already in discussions to have future student(s) complete this step.

SURF Abstract Submission & Post Program Survey 2020

Name	Elena Oprea
Year of Graduation	2023
SURF Advisor	Steve Williams; Biological Sciences
Secondary SURF Advisor	Jessica Grant
SURF Field of Study	Biological science
Title of Abstract/Research	Culture and Subsequent Growth of C6/36 Cells in Favorable

Please type your abstract below.

The mosquito Aedes albopictus is one of the most dangerous invasive species and is a major vector of arboviruses, growing public health concerns globally (Vega-Rúa et al. 2020). Being able to understand sex determination and identify sex determination genes in Aedes mosquitos is a fundamental step for potential future projects involving transgenic mosquitoes (de Araújo et al. 2018). Knocking out important genes for sex determination,we may be able to prevent a population of mosquitoes from reproducing and spreading disease (de Araújo et al, 2018). The Nix gene acts as a “dominant master switch” for male sex determination and has great potential for developing mosquito control strategies to reduce vector populations of Aedes mosquitos through female-to-male sex conversion (Aryan et al, 2019).

This summer, as a start point and reference I used a paper by Liu et al. 2019 which investigated if the Nix gene is a male-determining factor in the Aedes albopictus mosquito. My main focus for the summer was the culture and subsequent growth of C6/36 cells in favorable artificial conditions and the replication of the CRISPR/cas9 knockout experiment of the Nix gene in C6/36 cells. C6/36 is a cell line established in 1967 from freshly hatched Aedes albopictus larvae. These cells are commercially available, widely used to study virus-mosquito interactions.(Miller et al. 2018).

The goal of my SURF 2021 project was to grow healthy C6/36 cells. I and several other students in the lab hope to perform CRISPR and RNAi experiments in the fall. Successful cell culture depends on many factors like the reagents used, sterile technique, equipment and proper set up. This summer I learned basic principles of cell culture and got valuable hands-on experience in aseptic technique, thawing of the cells, passing cells, and eradication of yeast and bacterial contamination. While the process was time consuming with several setbacks it was incredibly rewarding to see the cells grow and multiply.

I started planning the CRISPR/Cas9 knockout experiment that will investigate whether Nix gene regulates the sex determination pathway. Before performing the experiment, I had to do the theoretical part. I learned what a guide RNA is and its function in CRISPR/Cas9. How to clone sgRNA in a plasmid vector and transfection of the cells. I wrote detailed protocols for all the steps necessary, material lists and will be performing this experiment during the Fall 2021 semester.

SURF Abstract Submission & Post Program Survey 2020

Name	Michelle Chen
Year of Graduation	2023
SURF Advisor	Cristina Suarez; Chemistry
If your SURF Advisor was not listed above you can enter their name here.	Elizabeth Jamieson
SURF Field of Study	Chemistry

Please list co-authors of your abstract (if applicable) Jiayun Chen

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DNA is constantly being oxidized by reactive oxygen species (ROS) produced exogenously and endogenously that covalently modify its structure, which can lead to permanent mutations and cancer. Within DNA, guanine bases have the lowest reduction potential making them easily oxidized. When guanine is oxidized, 8-oxoguanine (8-oxoG) is produced and leads to G → T transversion mutations (Crenshaw *et al.*, 2011). The 8-oxoG has an even lower reduction potential than G, therefore making 8-oxoG more likely to undergo further oxidation. The oxidation of 8-oxoG produces hyper-oxidized guanine lesions, such as the spirominodiydantoin (Sp) lesion. Unlike 8-oxoG, Sp contains a chiral carbon, which produces a pair of diastereomers that can be separated by High-Pressure Liquid Chromatography (HPLC) (Figure 1).

This summer, we re-started a research project that had been shutdown because of COVID since March 2020. Carbonate radicals were used to oxidize 8-oxoG in an 11-mer oligonucleotide, and the products were purified with HPLC (Figure 2, 3). The purification procedure was optimized by minimizing the time spent on each run. The automation of HPLC utilizing the autosampler and fraction collector was investigated. The autosampler was used to inject samples of control DNA and the fraction collector was used to collect the signature peak of the control DNA. Due to the closeness of the two Sp lesion peaks, we are still trying to experiment using the fraction collector for Sp lesion purification. In the future, we plan to use Nuclear Magnetic Resonance (NMR) to perform a comparative study on the structural and kinetic effects of Sp diastereomers in an 11-mer DNA duplex.

Figures

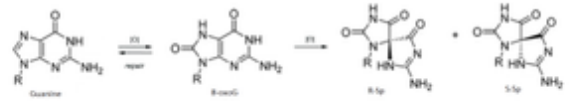

Figure 1. Guanine oxidation pathway to 8-oxoG, R-Sp, and S-Sp.

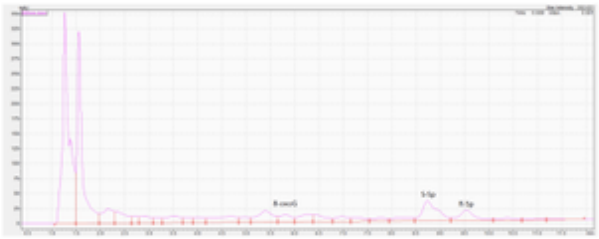

Figure 3. HPLC demonstrating the elution order of 8-oxoG and Sp diastereomers.

References

Crenshaw, C., Wade, J., Arthanari, H., Frueh, D., Lane, B., and Nunez, M. Hidden in Plain Sight: Subtle Effects of the 8-oxoguanine Lesion on the Structure, Dynamics, and Thermodynamics of a 15-Base Pair Oligodeoxynucleotide Duplex. *Biochemistry* **2011**, 50, 8463-8477.

Control

5' - $C_1 C_2 A_3 T_4 C_5 G_6 C_7 T_8 A_9 C_{10} C_{11}$ - 3'
3' - $G_{12} G_{13} T_{14} A_{15} G_{16} C_{17} G_{18} A_{19} T_{20} G_{21} G_{22}$ - 5'

Sp Lesion

5' - $C_1 C_2 A_3 T_4 C_5$ **Sp** $C_7 T_8 A_9 C_{10} C_{11}$ - 3'
3' - $G_{12} G_{13} T_{14} A_{15} G_{16} C_{17} G_{18} A_{19} T_{20} G_{21} G_{22}$ - 5'

Figure 2. Sequence of 11-mer oligonucleotide control and Sp lesion DNA.

Title of Abstract/Research DNA spirominodiydantoin Lesion

Please type your abstract below.

DNA is constantly being oxidized by reactive oxygen species (ROS) produced exogenously and endogenously that covalently modify its structure, which can lead to permanent mutations and cancer. Within DNA, guanine bases have the lowest reduction potential making them easily oxidized. When guanine is oxidized, 8-oxoguanine (8-oxoG) is produced and leads to G → T transversion mutations (Crenshaw et al., 2011). The 8-oxoG has an even lower reduction potential than G, therefore making 8-oxoG more likely to undergo further oxidation. The oxidation of 8-oxoG produces hyper-oxidized guanine lesions, such as the spirominodiydantoin (Sp) lesion. Unlike 8-oxoG, Sp contains a chiral carbon, which produces a pair of diastereomers that can be separated by High-Pressure Liquid Chromatography (HPLC) .

This summer, we re-started a research project that had been shutdown because of COVID since March 2020. Carbonate radicals were used to oxidize 8-oxoG in an 11-mer oligonucleotide, and the products were purified with HPLC . The purification procedure was optimized by minimizing the time spent on each run. The automation of HPLC utilizing the autosampler and fraction collector was investigated. The autosampler was used to inject samples of control DNA and the fraction collector was used to collect the signature peak of the control DNA. Due to the closeness of the two Sp lesion peaks, we are still trying to experiment using the fraction collector for Sp lesion purification. In the future, we plan to use Nuclear Magnetic Resonance (NMR) to perform a comparative study on the structural and kinetic effects of Sp diastereomers in an 11-mer DNA duplex.

References

Crenshaw, C., Wade, J., Arthanari, H., Frueh, D., Lane, B., and Nunez, M. Hidden in Plain Sight: Subtle Effects of the 8-oxoguanine Lesion on the Structure, Dynamics, and Thermodynamics of a 15-Base Pair Oligodeoxynucleotide Duplex. Biochemistry 2011, 50, 8463-8477.

SURF Abstract Submission & Post Program Survey 2020

Name	Tianmei Zhu
Year of Graduation	2023
SURF Advisor	Marsha Pruett; Psychology
Secondary SURF Advisor	Jonathan Alschech
SURF Field of Study	Psychology

Title of Abstract/Research

Are separated/divorced same-sex families more likely to establish equal coparenting? A preliminary outcome from a court-based program

Please type your abstract below.

This exploratory study collected and analyzed parenting plans from divorced/separated same-sex and heterosexual parents living in Hampshire county, Massachusetts (N=50; 86% heterosexual, 14% same-sex). The assessment includes the examination of children's living arrangements in daytime parenting time, the number of overnights, the consistency, and the general schedule types. By coding the answers and comparing the differences between these two groups of participants, a tendency among same-sex parents to practice a more equal and regular parenting plan emerged, suggesting the potential benefit of post-divorce/separation relationships and individual well-being.

SURF Abstract Submission & Post Program Survey 2020

Name	Fubin Song
Year of Graduation	2022
SURF Advisor	Alexandra Strom, Chemistry
SURF Field of Study	Organometallic chemistry

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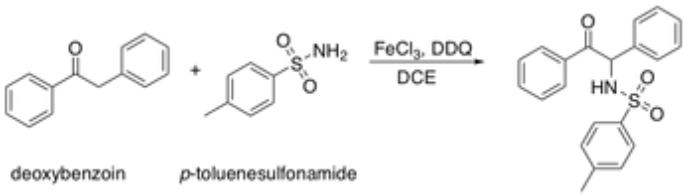

Title of Abstract/Research Iron-catalyzed Oxidative α–Amination of Ketone Derivatives

Please type your abstract below.

α-Amino ketones are a key structure in pharmaceutical and biologically active compounds. Previous approaches to achieve α-amination have used various metal and non-metal catalysts,1 but iron salts and other transition-metal salts remained relatively unexplored despite their benefits of being environmentally friendly, abundant in nature and lower in monetary costs. During our 10-week SURF research, we studied a novel method using iron (III) salts to catalyze the formation of the C–N bond between the α-carbon of ketones and primary sulfonamides under oxidative conditions. Our approach used deoxybenzoin as the ketone, p-toluenesulfonamide as the nitrogen source, iron (III) chloride as the catalyst, DDQ as the oxidant and DCE as the solvent. Control experiments confirmed that the iron salt and oxidant were necessary for the formation of our desired product. Using an internal standard, we obtained NMR yields of the desired α-amino ketone product. However, our yields varied significantly (over a range of about 20%) even with the same experimental conditions. We approached this problem by varying the workup procedure and experimenting with different orders of addition. We postulated that water, air, and order of addition might have an effect on the yield, and although added water lowered the yield significantly, the effects of air and order of addition are still unclear. We also experimented with other iron salts, oxidants, solvents, temperatures and additives (e.g., acids, bases, salts and ligands), but beyond initial increases due to changes in procedure, temperature and iron catalyst, the yield has only decreased with additional changes. It was discovered that, under those modified experimental conditions, halogenation might take place at the α-position carbon of the ketone if α-amination failed—we observed the halogenated product, a mixture of the halogenated and the aminated products, or a decrease in yield of amination. In the future, we will continue to optimize the experimental conditions to try to increase the yield. Other ketones and amines will be used to test the scope of the reaction.
References:
1. J. Am. Chem. Soc. 2013, 135, 16074–16077; Org. Lett. 2019, 21, 7466–7469; Org. Lett. 2020, 22, 5968–5972; Tetrahedron 2004, 60, 8747–8782; Tetrahedron Lett. 2018, 59, 734–738.

SURF Abstract Submission & Post Program Survey 2020

Name	Zoe Gardner
Year of Graduation	2022
SURF Advisor	Michael Barresi, Biological Sciences
SURF Field of Study	Biological Sciences

Please type your abstract below.

Reelin is an extracellular glycoprotein known to play a key role in both brain patterning and synaptogenesis. Abnormal Reelin signaling has been linked to a number of disorders including Autism Spectrum Disorder, Schizophrenia, Alzheimer's, and Bipolar Disorder. In the mammalian cerebral cortex, it has been shown that Reelin signaling through its two receptors, Very Low Density Lipoprotein receptor (Vldlr) and Apolipoprotein E receptor-2 (ApoER2), plays an important role in the positioning of neuronal progenitor cells. It remains unclear as to how reception through ApoER2 or Vldlr might differentially influence neurogenesis and the output of specific behaviors. I have taken advantage of the powerful genetics and imaging accessibility of the Zebrafish (Danio rerio) model system to dissect the function of different Reelin pathway interactions on gene expression, cellular patterns, and behavioral activities. I have found that reelin expression is significantly reduced in subsets of neurons in both our reelin and vldlr mutants but normally expressed in our apoER2 mutants. Interestingly, apoER2 expression appears reduced in the ventricles of reelin and vldlr mutants but normal in apoER2 mutants. Our behavioral analysis of reelin mutants has identified an altered response to social novelty. Additionally, our analysis of the apoER2 mutants has identified abnormal overall behavior pointing to a possible anxiety-like phenotype. Using our existing reelin pathway mutants, I am working to develop a comprehensive model of how the Reelin signaling may exhibit important cross-receptor regulation at the transcriptional level that leads to distinct developmental and behavioral outcomes.

My focus for the past six months has been optimizing our lab's QRT PCR protocol and implementing this protocol in order to quantify changes in the expression of our target genes in our reelin pathway mutants. Optimization of this protocol required running multiple trials to find the ideal temperatures for both annealing and extension that would both increase the efficiency of the reaction and reduce primer dimers. Additionally, we had to adapt the RNA extraction protocol to both increase the overall quantity and quantity of RNA, and, in the process, we discovered that in order to maintain quality RNA should be fully processed on the day of the extraction. Finally, we worked to create programs to normalize the data output of our QRT PCRs.

In addition to this work on QRT PCR, I also worked to create transgenic mutants for all of our genes of interest. The transgenic lines I worked with included: olig2 GFP, gfap: GFP caax and vglut RFP. Creating these lines required multiple genotyping protocols and then subsequent breeding and animal care work. I worked closely with Diamond Lewis to analyze and interpret the results of several 5 chambered tank social assays done on mutant and wild-type siblings from both our apoER2 and reelin lines. An additional focus of my work this summer was in mutant line maintenance, genotyping, breeding, and animal care in general. This summer I presented a poster at the Society for Developmental Biology's national conference. I also presented my progress at multiple lab meetings throughout the summer. My hope is that the work that has been done this summer will provide a good foundation for further work to characterize and understand Reelin signaling in zebrafish.

SURF Abstract Submission & Post Program Survey 2020

Name	Emma Civello
Year of Graduation	2024
SURF Advisor	Ileana Streinu, Computer Science
SURF Field of Study	Computer Science

Please type your abstract below.

This summer, I studied various computer science algorithms in Professor Streinu's Linkage Lab. I used Mathematica, a language that supports interactive visual models, to create animations of four sorting algorithms: selection, insertion, quick, and merge sorts. The apps allow one to walk step-by-step through the algorithm using a slider bar, and they can be used to teach new computer science students. Professor Streinu guided me in creating graphics that are clear in their colors and layout, and through the process, I learned not only how to make the underlying code work but also to think about an effective end product.

The second half of my SURF project focused on another set of algorithms: pebble games. Pebble games involve trying to insert a list of edges between a list of nodes, where each node starts with K pebbles, L+1 pebbles must be present on two nodes to insert an edge between them, and a pebble is removed from the starting node when an edge is inserted. If a node does not have pebbles on it, a depth-first search for pebbles is performed. Pebble games can be used to determine properties of a graph. For example, applying Laman's Theorem to a 2,3 pebble game reveals whether a graph is over-constrained, minimally-rigid, or sparse. I implemented the 2,3 pebble game with a conclusion screen using Laman's Theorem and an extension which detects rigid sub-components and colors edges accordingly. While creating these apps, I practiced the software engineering principle of "Model-View-Controller" as I organized functions so that each had a specific purpose related to either the algorithm, graphics, or user interaction.

Creating these applications has given me the mathematical and technical background to pursue research in the Linkage Lab going forward. Next steps in the graph-modeling project include finding and showing components with redundant edges and implementing and studying other (not 2,3) pebble games.

SURF Abstract Submission & Post Program Survey 2020

Name	Clara Slesar<
Year of Graduation	2022
SURF Advisor	Laura Katz, Biological Sciences<
SURF Field of Study	Biological Sciences

Please type your abstract below.

Protists such as testate amoebae (of the order Arcellinida) and SAR (a major clade that encompasses approximately three fifths of all eukaryotic diversity) are found globally, in many different environments. Previous studies in the Katzlab have shown that testate amoebae are nearly identical in individuals sampled from bogs in Massachusetts and Maine (unpublished data, Katzlab). This indicates gene flow occurring between these distant study sites, which leads to the question of "how." How do testate amoebae (microscopic unicellular organisms) disperse, reproduce, and become established in communities hundreds of miles apart? There are many hypotheses, from Katzlab members and other microbiologists, including dispersal by wind or by birds or other animals (Beyens et al., 2016).

In order to test the hypothesis of whether birds might carry Arcellinida, SAR and other microbes, I partnered with local bird banders in and around Northampton, MA to collect samples. They swabbed the feet and feathers of the wild birds they caught for their study before banding and releasing the birds. I then completed DNA and RNA extractions on 32 swab samples, and used both Arcellinida-specific and SAR-specific primers to run community PCRs on my samples. In many samples, I was able to amplify DNA with both sets of primers, which indicates that both Arcellinida and SAR were present on the birds' feet and feathers in my study. This is an important first step in answering the question of whether birds may be a dispersal mechanism for testate amoebae and other protists.

In the final step of my SURF project, I completed 36 PCRs in triplicate to be sent into another lab for sequencing. I chose 24 of the best-amplified samples to send on the Katzlab plate for sequencing this summer. I will continue working on this project this coming fall and spring for my senior thesis, and will analyze the data to begin characterizing the microbial communities on birds' feet and feathers. I will consider how these bird-microbe interactions may be influencing complex ecosystem dynamics, both locally and globally. Finally, I will look into the broader and more long-term implications of my study on bird-associated protists through the lens of climate change.

SURF Abstract Submission & Post Program Survey 2020

Name	Nevia Selmon<
Year of Graduation	2022
SURF Advisor	Stephanie Jones, Exercise and Sports Studies<
SURF Field of Study	Exercise and Sports Studies

Please type your abstract below.

Repetitive movement patterns performed by skilled athletes, particularly in asymmetric sports, may result in muscle firing patterns that reduce the body's ability to protect the spine and leave it vulnerable to injury. Rowers have a particularly high incidence of low back pain (LBP) that seems to correlate with training intensity, indicating that cumulative trauma from repetitive movements may contribute. However, the specific injury mechanism is not known. Given that the crew team participates in sweep rowing, which requires repetitive asymmetric pulls to one side of the body, these athletes may be more susceptible to injury. Of greater concern is that a significant portion of training occurs on land, using rowing ergometers that promote symmetrical spine movement; this conflict between activation patterns reinforced during training and those required for on-water rowing may provide inadequate protection for the spine. The purpose of this project is to examine the movement patterns of collegiate rowers, with and without LBP to identify whether altered muscle activation might play a role in LBP among these athletes. The goal is to understand contributors to LBP in rowers so we may ultimately develop therapies to reduce pain and protect against reinjury, and training programs that will minimize the likelihood of an initial back injury.

Throughout this summer in the Movement Science Laboratory (MoveS), I have participated in a wide range of activities supporting this research on lower back pain in female collegiate rowers who are members of Smith College's rowing team. During the summer, I have recruited, screened and scheduled rowers for laboratory testing and conducted interviews of study participants to determine rowing and low back pain and injury history. When the participants came into the lab, I assisted with experimental setup including preparation of tracking markers and electromyography (EMG) sensors. During data collections, I operated the data acquisition software (which controls both high speed infrared cameras and EMG sensors) to record rowing trials in different conditions (preferred steady state rowing on stationary erg, maximal effort trials at 20 and 30 strokes per minute, preferred steady state rowing on sliders which permit free movement of the erg, and maximal effort on sliders at 20 and 30 spm). I have been working on data processing by identifying the kinematic markers that were placed on body segments and creating models. I have also created electronic databases for survey and questionnaire data, and entered corresponding questionnaire and interview data. These surveys included the McGill Pain Questionnaire, the Tampa Scale of Kinesiophobia, the rating of perceived exertion, and Numeric Pain Rating Scale. I also created an organizational database to track data processing and analysis completion as lab members continue to work through the data that we have collected.

In addition to this ongoing study, I have been involved in several additional projects. I attended a training on our new inertial sensors (Opal Sensors, APDM Inc.) that we are pilot testing for use in assessing rowers' movement patterns while on water. I also created a lab website; on all areas of our research, poster presentations, background on equipment we use, and how others can get involved. This also involved contacting all members for more information on their individual research within the lab.

SURF Abstract Submission & Post Program Survey 2020

Name	Joy Mahoney<
Year of Graduation	2024
SURF Advisor	Julianna Tymoczko, Mathematics and Statistics<
SURF Field of Study	Mathematics

Title of Abstract/Research Generalized Splines on Dual Graphs to Triangulations

Please type your abstract below.

Splines are a fundamental tool across applied mathematics and analysis, used in areas such as computer graphics, engineering models, and data interpolation. Our research considers a more abstract idea of splines in which we work with an algebraic-combinatorial generalization of splines on an edge-labeled graph. A spline on this graph is a labeling of vertices so that edge-sharing vertex-labels differ by a multiple of the shared edge-label. As part of a longstanding open problem sometimes called the “upper-bound conjecture”, we are developing approaches to find a basis (and/or the dimension) of the space of splines when using polynomial labels of degree at most 2. Restricting consideration to connected graphs with vertices of degree at most 3, this report builds an approach for studying this open question that uses “parachute” subgraphs as the basic unit of study. In particular, we introduce “layered parachutes”, as well as conditions on the coefficient C of polynomial edge-labels of the form (x-Cy)^2 such that a non-trivial space of degree-2 splines exists for different forms of layered parachutes. We provide proof of these conditions for single to three-layer parachutes, as well as a conjecture generalizing these conditions.

SURF Abstract Submission & Post Program Survey 2020

Name	Claire Jordan<
Year of Graduation	2022
SURF Advisor	Marney Pratt, Biological Sciences<
SURF Field of Study	Biodiversity, ecology, and conservation

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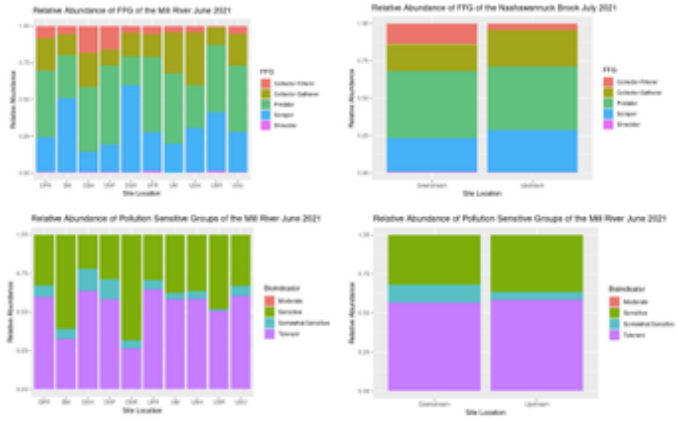

Title of Abstract/Research

Macroinvertebrates as a measure of river health: examples from two river environments in Northampton, Massachusetts.

Please type your abstract below.

Aquatic macroinvertebrates serve as important bioindicators of river health, and an understanding of population, diversity, and population dynamics in macroinvertebrates can offer insight into levels of pollution and sedimentation in river environments. On Smith College campus, the removal of sediment from Paradise Pond affects the environment downriver of the dam, and monitoring macroinvertebrate populations downstream of the dam can help us understand exactly what effects sediment redistribution may be having. The goal of this lab was to collect, identify, and count macroinvertebrates found upstream and downstream of Paradise Pond in the Mill River, in order to contribute to Professor Pratt's long term project monitoring the effect of sediment redistribution in the pond on the health of the Mill River, by comparing downstream sites to locations upstream of the dam, and acquiring data that can be compared to data from previous years from the Mill River. Our team conducted work in the field in order to collect macroinvertebrates and water quality data, then identified and counted the macroinvertebrates collected in 2021. Additionally, we identified macroinvertebrates collected in 2020 that could not be identified due to the COVID pandemic.

The team also developed, tested, and implemented a new study at Nashawannuck Brook, at the former Pine Brook golf course in Northampton. This location is currently undergoing ecological restoration, and an understanding of existing macroinvertebrate communities may influence the restoration decisions the team involved in that project may make, as well as serving as a baseline to compare future samples in the brook to. This project taught the group important skills regarding experimental design, as well as how to effectively communicate results and data to outside groups.

While the majority of the data collected here will be analyzed in comparison to previous years once the data from 2020 has finished being processed, we were able to see patterns between upstream and downstream locations when looking at the functional feeding group and pollution sensitivity of the organisms collected. Upstream and downstream locations had distinct community structures and macroinvertebrate populations that were also distinct from populations in the Nashawannuck Brook, reflecting the difference in health between these environments. Data from the Nashawannuck Brook and Mill River will be further analyzed by future students in order to understand temporal patterns and the effect of anthropogenic interference on river environments.

SURF Abstract Submission & Post Program Survey 2020

Name	Nelida Ayala<
Year of Graduation	2023
SURF Advisor	Michael Barresi, Biological Sciences<
SURF Field of Study	Biology

Please type your abstract below.

The complex zebrafish forebrain has many cell types involved. Among the important cells and essential signals involved in development Cranial Neural Crest Cells (CNCC) play an important part in the forebrain as they lead to commissure development. CNCC are a key cell population required for the development of many structures during embryogenesis or the formation of the embryo.
CNCC originate near the dorsal neural tube and migrate to the forebrain. To study CNCC, we need to be able to see them, therefore we use a fluorescent protein transgenic line that labels CNCC to watch the migration to the forebrain. However, we are losing expression of the CNCC fluorescent label in the forebrain, which implies that CNCC may be differentiating into another cell stage.
In addition, recent research demonstrates that a specifically secreted morphogen, meteorin (mtrn), is influential in early neural development. This summer, I explored the placement and role of mtrn in the forebrain to have a more thorough understanding of key players and modes of communication that underlie forebrain development. Through procedures such as Immunohistochemistry and imaging on the Leica Confocal Microscope, we concluded that that mtrn is in the forebrain and may play a direct role on brain development than ever thought before.

SURF Abstract Submission & Post Program Survey 2020

Name	Sungwoo Hwang<
Year of Graduation	2022
SURF Advisor	Steve Williams, Biological Sciences<
SURF Field of Study	Biochemistry

Please type your abstract below.

Aedes polynesiensis is the principal mosquito vector of various viruses and parasites, such as dengue virus and Wuchereria bancrofti, the causative agent of lymphatic filariasis. I focused on the circadian clock genes of the mosquito in hopes of understanding more about its expression levels and patterns. I also made a clock gene table to have a final mRNA sequence of all of the clock genes for the Ae. polynesiensis genome paper. The circadian clock is crucial to insect vector efficiency because it determines host-seeking rhythmicity. The circadian rhythm is generated at the molecular level by interlocked transcriptional and translational feedback loops. Most organisms have four main regulatory genes involved with their circadian rhythm: period (per), timeless (tim), cycle (cyc), and clock (Clk), short for Circadian Locomotor Output Cycles Kaput. These four genes encode their respective proteins PER, TIM, CYC, and CLK to establish a rhythmic pattern.
My main focus over the summer was to prepare for RNAi in the fall by synthesizing cDNA from RNA of Clk, cyc, and cry1. Since Aedes albopictus and Ae. polynesiensis clock genes are highly conserved, I planned on doing RNAi on clock genes in Ae. albopictus cells as well as Ae. polynesiensis. I extracted RNA from Ae. albopictus female and male samples to do a cDNA synthesis and amplified cDNA copies of Clk and cyc. I aim to continue this research in the fall by transfecting Ae. albopictus cell lines to knock down CLK, CYC, and CRY1. I plan on observing the expression levels of other clock genes using qRT-PCR and, in the future, hope to assess the mosquito behaviour when certain genes are knocked down.

SURF Abstract Submission & Post Program Survey 2020

Name	Katherine Bernklau Halvor<
Year of Graduation	2023
SURF Advisor	Patricia Cahn, Mathematics and Statistics<
SURF Field of Study	Mathematics

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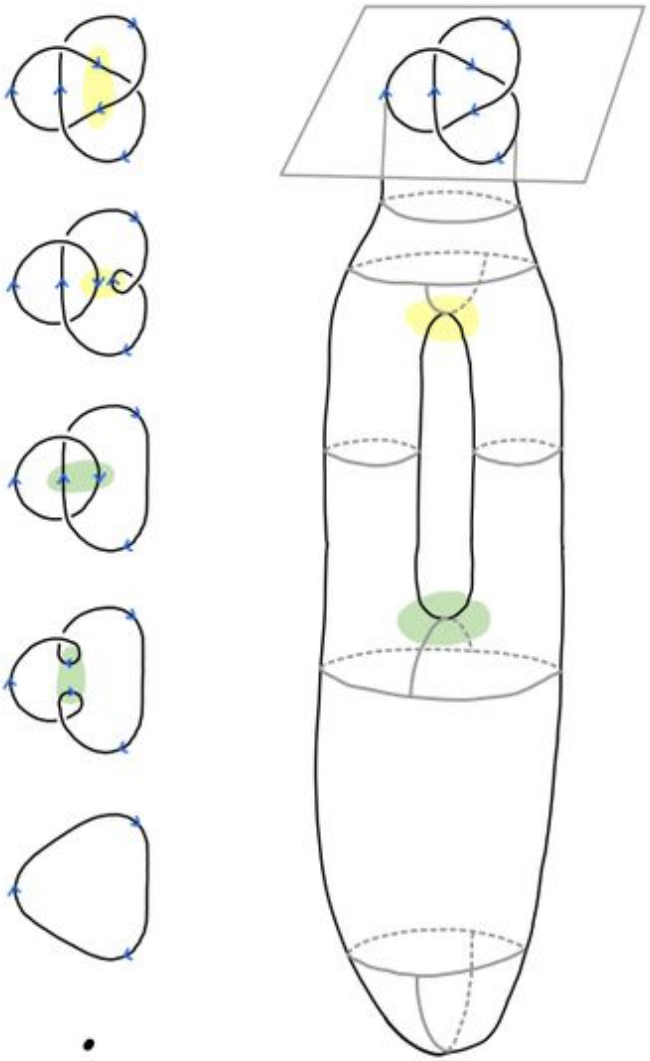

Title of Abstract/Research p-Colorability of Surfaces Bounded by Knots

Please type your abstract below.

A knot in mathematics is similar to a knot in real life. Imagine that you take a piece of string and tangle it up. Then, glue the two ends of the string together. When we draw a knot on paper, we draw a diagram with over-under crossing information. However, there are a couple more rules to these theoretical knots. A knot is an embedding of the circle in 3D space. An embedding simply means that the circle does not touch itself anywhere.

A knot diagram can be deformed to another knot diagram of the same knot. In order to deform a knot, we use the three Reidemeister moves to assure that our knot does not pass through itself while being deformed, because that would result in a completely different knot.

There are knot invariants which are numbers that can be used to tell different knots apart. One of the most important invariants for our purposes is the 3-coloring and, by extension, the p-coloring. The 3-coloring assigns 3 different colors to a knot, using the following rules: each arc (meaning if you follow a strand of the knot, the arc will end at a crossing where that strand is under) is assigned a color, at each crossing the 3 strands either have to be all the same color or three different colors, and at least 2 of the colors must be used in the entire diagram. If the determinant is divisible by 3, then it is 3-colorable. The p-coloring is a similar invariant where the “3” is replaced by any prime number p. However, for the p-coloring, at each crossing, the sum of the two bottom strands must be equivalent to twice the upper strand mod p.

We studied surfaces bounded by knots, where the surface lies in the 4th dimension. The 4-genus of the knot is the minimum number of holes in any such surface. These surfaces are defined by the amount of births, deaths, and saddles they have, which can be used to compute the 4-genus. A p-coloring of the knot will extend over the surface when the saddle moves can be applied using only strands that share the same color. We then explored for which knots the minimal 4-genus and the minimal p-colored 4-genus are the same.

SURF Abstract Submission & Post Program Survey 2020

Name	Ruiyi Zhang
Year of Graduation	2023
SURF Advisor	Lauren Duncan, Psychology
SURF Field of Study	Psychology

Please type your abstract below.

After 40+ years of family planning policies, China's total fertility rate reached 1.696 births per woman in 2019, which is 2.134 fewer births than the average before these policies. Although many, even the Chinese government, believed in birth control propaganda and coercive reproductive policies until now, its effectiveness is relatively unstable and is now diminishing. When the one-child policy was enacted in 1980, even though the fertility rate dropped rather significantly, people's fertility intention remained high, especially in rural areas where illegal birth was often spotted. It wasn't until the 1990s when both rural and urban populations shared a drastic decrease in their fertility intention. These days, due to the legacy of decades of strict population control, population aging has become a severe national issue. While the government advocates for a pro-natalist society and has relaxed its fertility restrictions to a maximum of three children per family, recent reports have demonstrated that most people fail to respond to the government's calling. To investigate the reason behind the phenomenon and how the changing context of the fertility policies influences people's attitudes about fertility and women's reproductive capacity in China, I conducted a literature review and an interview with a Chinese scholar. I analyzed the historical changes in women's reproductive decisions and behaviors and the difficulty that the current population control policies impose on reproductive justice activism. I discovered that coercive laws and regulations alone do not result in significant changes in Chinese women's fertility intentions and behavior. Instead, a neoliberal governing technique of self-regulation and self-management adopted during the one-child policy period has led to people's extensive internationalization of disciplines that limit reproductive behaviors. By persuading people into using a rational thinking mindset while making fertility decisions, women have come to realize that it is easier for themselves and their families to raise only one child. Such persuasion managed to make women and their bodies self-governable subjects. I conclude that although such a strategy conceals and justifies the government's exercise of power over matters of pregnancy and its consequences, the neoliberal mindset has now become a significant reason why people's reproductive intention fails to match their actual behavior. Without sufficient cultural and governmental support for reproduction and child-rearing, people tend to defy the pro-natalist population policies. However, such defiance also leads to negative consequences, especially for women, since they become unproductive and irresponsible citizens who exacerbate aging issues and ignore the possible future economic decline.

SURF Abstract Submission & Post Program Survey 2020

Name	Brenda Leyva Garcia
Year of Graduation	2022
SURF Advisor	Michael Barresi, Biological Sciences
SURF Field of Study	Biology/Neuroscience

Title of Abstract/Research Establishing a Mutant Line to Characterize Meteorin Knockout Phenotypes in Zebrafish

Please type your abstract below.

In the Barresi Lab, I work in the Disease Modeling team, with an emphasis on studying the roles of meteorin and meteorin-like in zebrafish development. Both are putative morphogens that have been established to have a role in glial differentiation and neurite growth, and meteorin, in particular, has been linked to differentiation of cerebellar astrocytes into radial glia. However, the expression of meteorin and meteorin-like in the zebrafish embryo has not been mapped out yet, neither have their roles in the differentiation of different cell types involved in neural development. During the spring semester, the laboratory targeted putative promoter regions of meteorin with both CRISPR-cas9 and gRNA directed at the proximal and distal regions of exons encoding meteorin to create a promoter-less mutant line.

This summer, in learning how to characterize embryonic development as well as how to apply techniques used to map out expression and identify gene regions, we have worked to establish a knockout mutant line. Success was determined by identification of the potential deletion of the promoter region. Results showed deletion of the promoter sequence of meteorin, but further tests with PCR targeting upstream regions will be needed to identify if the region was cut or mutations prevented expression of meteorin. Confirmation of a successful cut of the promoter region will help establish a mutant founder line with promoter mutations, which in turn will allow the study of the cellular phenotypic effects of meteorin knockout, particularly in cell types involved in neural development that may be guided and influenced by meteorin secretion. Throughout the summer we attempted to establish these phenotypes using g0 zebrafish embryos (embryos injected with mtrn gRNA and cas9 at the 1-2 cell stage of development) using immunocytochemistry with markers for radial glia, cellular proliferation, and axon growth. However, it would be necessary to have a mutant founder line for which immunocytochemistry can be performed at different time points in development to better understand the extent to which meteorin knockdown can affect different cell types.

SURF Abstract Submission & Post Program Survey 2020

Name	Jacqueline Wang
Year of Graduation	2023
SURF Advisor	Niveen Ismail, Engineering
SURF Field of Study	Environmental Engineering

Please type your abstract below.

In water treatment systems, viruses can be removed from the water through UV disinfection. Zooplankton found in the water may reduce viral loads via predation or may protect viruses from UV inactivation.. MS2 is a bacteriophage that is often used to model human viruses. Previous work in the Ismail lab shows a 4 log removal of MS2 from the water by Brachionus plicatilis rotifers. Our hypothesis is that rotifers may protect MS2 from solar inactivation rather than enhance inactivation.

We set up multiple beakers in a water bath with constant temperature on the Season Room Balcony to test our hypothesis. Actinometery and spectrophotometery were utilized to obtain solar irradiance information. Experimental beakers contained rotifers, MS2 bacteriophage, and algae while control beakers contained only MS2 and algae. Dark controls were also employed. Experiments were conducted on sunny days for 12 hours.

Three rooftop experiments were run and each resulted in different data trends for MS2 disinfection. While our data is inconclusive for now, further investigation will continue in the fall.

The viability of MS2 RNA after exposure to rotifers is not well understood. We will use real time polymerase chain reaction (RT-PCR) testing to quantify MS2 RNA from samples collected over the summer.

SURF Abstract Submission & Post Program Survey 2020

Name	Mealaktey Sok
Year of Graduation	2024
SURF Advisor	Susan Voss, Engineering
SURF Field of Study	Engineering

Title of Abstract/Research Ear Canal Area Measurements from CT Scans

Please type your abstract below.

Non-invasive wideband acoustic immittance (WAI) measurements are a tool for diagnosing middle ear disorders. These WAI measures require the subject's ear-canal area in order to calculate several relevant diagnostic quantities. . Currently, industry standard values for area are considerably smaller than the values collected in this work. Only a few previous studies have collected measurements of the ear canal from live ears and used clear definitions for the entrance and termination.

This work used the ear-canal area measurement method developed by Auden Balouch in her Smith College honors thesis (2021),to measure ear-canal areas and lengths from a data set of CT scans collected by Dr. Aaron Remenschneider from UMASS Memorial Medical Center. This approach used the multi-planar reconstruction and measurement tools in the software program, OsiriX CT, to view and take measurements every 1-2 mm from the entrance to the termination of the canal.

During the summer SURF program of 2021, measurements were made on 24 ears (from 13 subjects) by two technicians. Measurements on a single ear took 5-7 hours to complete. Each technician made her measurements blinded from other measurements on the same ear. Using the software packages MatLab and Igor, plots that showcase the validity and reliability of Auden's method were made. These plots demonstrate how similar the blind data collections are to each other, which helps to validate the accuracy of Auden's method. We also created a video tutorial of Auden's method. This video, linked below, includes the basic setup and navigation of the software, as well as a step by step introduction on how to begin the first, second, third and final measurements on the ear, and what things to look out for. The ears measured were from a set of 110 total ears. In the fall we will continue to work to measure the remaining 86 other ears in this data set.

Video Tutorial https://drive.google.com/drive/folders/1VWzb2xhu-Lv6MW2327DSyp0ZYNdmbQ0F?usp=sharing

SURF Abstract Submission & Post Program Survey 2020

Name	Hannah Rappaport
Year of Graduation	2022
SURF Advisor	Laura Katz, Biological Sciences
SURF Field of Study	Biological Sciences

Please type your abstract below.

Foraminifera are a clade of largely marine testate, or shelled, amoebae that have become known for their complex life cycles and nuclear processes. As most research on Foraminifera has focused on their morphology, we are using high throughput sequencing coupled with fluorescence microscopy to better understand genome organization and nuclear development throughout the life cycle of these organisms. This summer, in preparation for my honors thesis on this topic, I continued two different projects. First, we are studying the codon usage bias, or uneven usage of synonymous codons, within the genomes of each major group of Foraminifera using transcriptomes extracted largely from field samples taken by our lab or published online. Preliminary results show that one major clade of Foraminifera, the Tubothalamea, have consistently high AT bias unlike the majority of other Foraminifera analyzed. This gives us an idea of the diversity of genome organization among Foraminifera. The next steps include repeating the analyses of codon usage after removing bioinformatic and symbiotic contaminants from the transcriptomes and to identify orthologous groups (genes) that may explain the stark differences in codon usage among foraminiferal groups. Second, we have been culturing two strains of a single-chambered Foraminifera, Allogromia. Unlike the less reliable field samples, lab cultures allow us to observe many individuals of the same species coming from the same conditions but at varying life stages. I have been researching and testing protocols to stain the nuclei of these individuals with DAPI, a fluorescent probe that binds to DNA along with other targeted probes. I am receiving training on both the widefield fluorescence and laser scanning confocal microscopes to track nuclear dynamics across life stages in comparison to whole genome and whole transcriptome amplification across life stages. This research will continue to illuminate the organization of a highly diverse group of eukaryotes that are essential members of marine carbon and nitrogen cycles.

SURF Abstract Submission & Post Program Survey 2020

Name	Britney Danials
Year of Graduation	2022
SURF Advisor	Marney Pratt, Biological Sciences
SURF Field of Study	Biology

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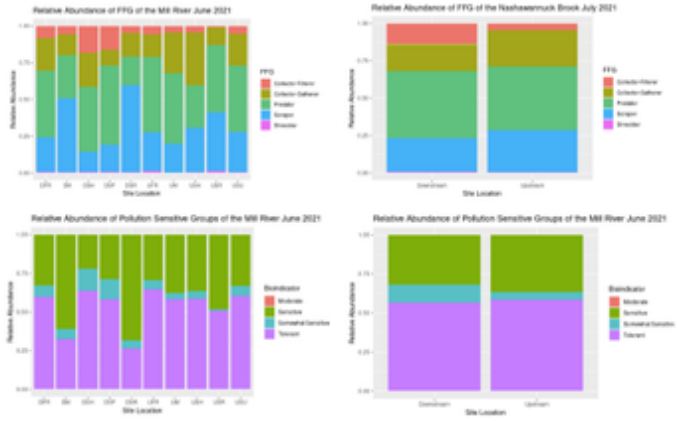

Title of Abstract/Research

Macroinvertebrates as a measure of river health: examples from two river environments in Northampton, Massachusetts.

Please type your abstract below.

Aquatic macroinvertebrates serve as important bioindicators of river health, diversity, and population dynamics. Macroinvertebrates can offer insight into levels of pollution and sedimentation in river environments. On the Smith College campus, the removal of sediment from Paradise Pond affects the environment downriver of the dam, and monitoring macroinvertebrate populations downstream of the dam can help us understand the effects of sediment redistribution. The goal of this lab was to collect, identify, and count macroinvertebrates found upstream and downstream of Paradise Pond in the Mill River. Our efforts aided the ongoing project monitoring of sediment redistribution by comparing upstream and downstream sites. Our team conducted fieldwork to collect macroinvertebrates and water quality data and later identify genus and species levels. Additionally, we identified macroinvertebrates collected in 2020 that could not be identified due to the campus disruption from the COVID pandemic.

The team also developed, tested, and implemented a new study at Nashawannuck Brook at Northampton's former Pine Brook golf course. This location is currently undergoing ecological restoration. An understanding of existing macroinvertebrate communities may influence the restoration decisions of the team involved in that project and serve as a baseline to compare future samples in the brook. This project taught the group the necessary skills regarding experimental design and effectively communicating results and data to outside groups.

The data collected from the Mill River will be analyzed compared to previous years once the 2020 data is finalized. Thus far, we were able to see patterns between upstream and downstream locations when looking at the functional feeding group and pollution sensitivity of the organisms collected. Future students will further analyze data from the Nashawannuck Brook and Mill River to understand temporal patterns and the effect of anthropogenic interference on our local river environments.

SURF Abstract Submission & Post Program Survey 2020

Name	Julia Sullivan
Year of Graduation	2022
SURF Advisor	Laura Katz, Biological Sciences
SURF Field of Study	Biology

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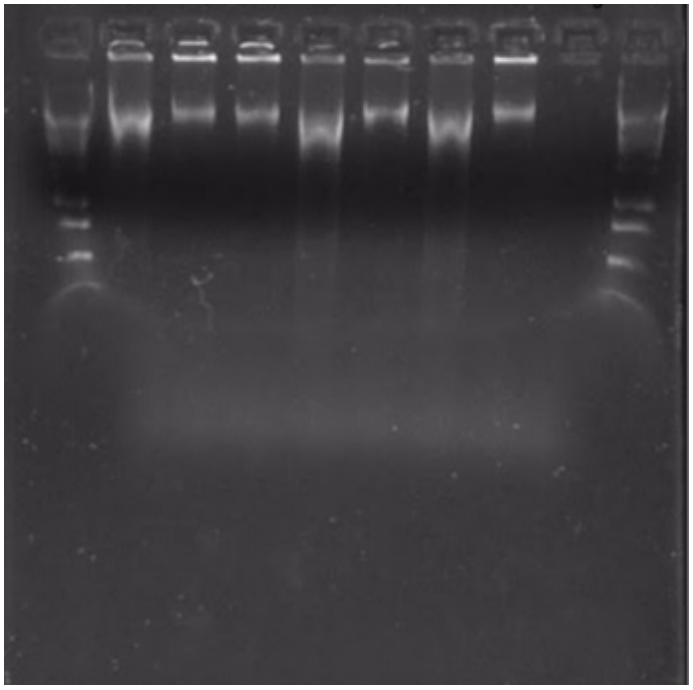

Title of Abstract/Research

Uncovering Potential Bacterial and Viral Symbiosis in Ciliophora

Please type your abstract below.

Ciliates are protists characterized by thin, hair-like cilia that surround their outer structures, those of which serve to facilitate movement and food capture. Ciliates are also distinguished by the presence of two nuclei within their single cell: the macronucleus and the micronucleus. The micronucleus acts as the ciliate germ line, but these genes are importantly not expressed. Conversely, the macronucleus donates the somatic genetic material needed for vegetative growth.

Protists are known to participate in symbiotic relationships with other microbes, especially bacteria and viruses. The purpose of my research this summer centered around analyzing the relationship between ciliate hosts and potential bacterial and/or viral symbionts. What do these relationships look like and are they entirely mutualistic? Can we determine, perhaps through RNA sequencing after isolation, how these symbionts --if present-- influence their hosts? In order to elucidate these questions, I joined a RNA Isolation project with fellow lab members Ragib, Wumei, and Ava. We first isolated single cells (specifically Chilodonella, Halteria, and Loxodes) under the camerascope, froze them, and subsequently performed RNA Isolation or Whole Genome Amplification in order to prepare for eventual sequencing. Before conducting RNA isolation, I researched Single Cell and Total RNA Isolation/Purification kits in order to determine which would align best with our needs --those being the presence of minimal (in our case, single) cell quantities and small genetic volumes. I then contacted several biotechnology companies for free and/or discounted samples so as to experiment without committing to any specific structure or workflow. Finally, I collaborated on comprehensive Katzlab WGA and RNA Isolation protocols, tailoring them to the particular availabilities of the lab.

Our first WGA was very successful; the gel showed fragmentation and remained uncontaminated as the negative control appeared negative upon viewing. These results indicated that we had sufficient DNA in order to continue with Illumina sequencing and bioinformatic analysis. Our first RNA Isolation was incomplete as we did not have the lab materials needed to quantify the genetic material. Although I am anticipating some error --as this was our first time using the Norgen Biotek kit and completing this experiment-- I am very excited to continue with subsequent isolation/sequencing experiments this fall in order to determine ciliate relationships on the symbiotic level as well as uncover what this potentially means for the larger, growing implications of antibiotic resistance (bacterial and viral specific).

SURF Abstract Submission & Post Program Survey 2020

Name	Ashlyn Bohn
Year of Graduation	2023
SURF Advisor	Stylianos Scordilis, Biological Sciences
SURF Field of Study	Biochemistry, proteomics

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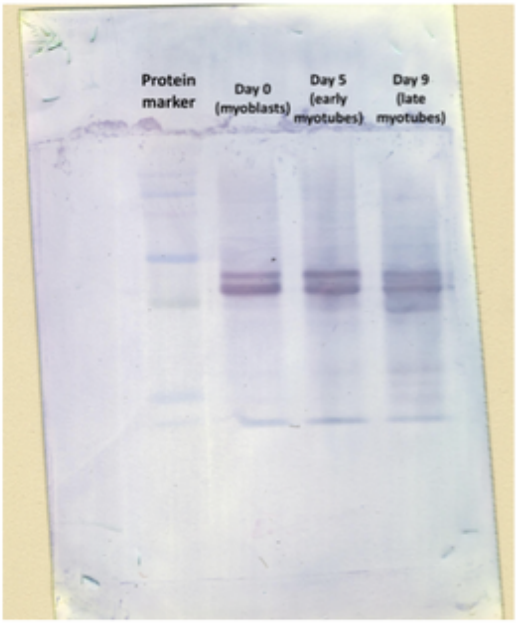

Figure 1. Immunoblot demonstrating the presence of ERK1/2 in each of the developmental stages of the C2C12 cell line.

Title of Abstract/Research

Mitogen-Activated Protein Kinases: An Immunoblotting Study

Please type your abstract below.

A mitogen-activated protein kinase (MAPK) is a type of eukaryotic enzyme that modifies a protein via phosphorylation. MAPKs are specific to the hydroxyl polar amino acids, Thr and Ser. MAPKs help cells respond to various stimuli and regulate many cell functions necessary to cell division and survival. Dysregulated MAPK signaling has been associated with a range of cancers, because this can lead to uncontrolled cell proliferation. Using protein extracts from mouse skeletal muscle cells, various MAPKs were identified at each stage of myogenic development.

Murine myocytes of the C2C12 cell line were grown in culture, typically three flasks at once. Once the myocytes reached 80% confluence, meaning they covered about 80% of the flask's bottom surface, they were then considered myoblasts (mononucleate, proliferating cells) and this established day 0 of their development. After day 0, the myoblasts began to fuse into multinucleate cells known as myotubes (bi- or multinucleate cells that have exited the cell cycle). On day 5, the cells reached their early myotube stage, and by day 9 they developed into late myotubes. With these cell samples, five major techniques were used to identify various mitogen-activated protein kinases at the different myogenic stages of the C2C12 cells.

First, a protein extract of the cells was made at each stage of development, so that there were samples of day 0 myoblasts, day 5 early myotubes, and day 9 late myotubes. Next, a Lowry assay was performed in order to estimate the protein concentration in each extracts. Using this concentration, 10-20 µg of protein from each sample and 5 µg of protein marker was then loaded into different wells of a SDS gel. Using SDS gel electrophoresis, all the proteins in a sample separated into bands by their apparent molecular weight. The proteins in this gel could then be transferred to a PVDF membrane so that the MAPKs could be detected using immunoblotting. Antibodies specific to the MAPKs of interest were used to visualize the bands of each respective protein on the PVDF membrane (Figure 1). A total of 8 different mitogen-activated kinase proteins were probed for: ERK1/2, p-ERK1/2, JNK, p-JNK, p38, p-p38, AKT1/2, and p-AKT1/2. Every non-phosphorylated MAPK was found to be present at each myogenic stage. While p-ERK1/2 was also found, bands from the other phosphorylated MAPKs failed to show up,

SURF Abstract Submission & Post Program Survey 2020

Name	Halley Lin-Jones
Year of Graduation	2022
SURF Advisor	Kevin Shea, Chemistry
SURF Field of Study	Organic chemistry

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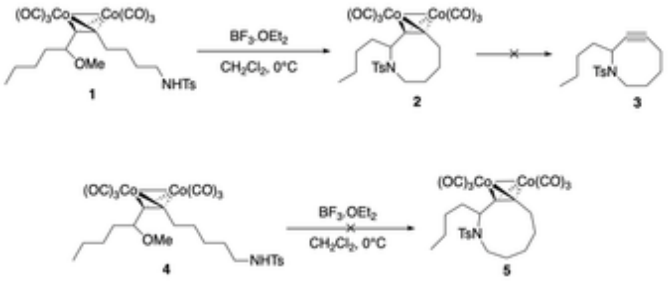

Title of Abstract/Research

Work towards the synthesis of strained 8-,9-, and 10-membered sulfonamide-containing cyclic alkynes using an intramolecular Nicholas reaction

Please type your abstract below.

Strain-promoted azide-alkyne cycloadditions (SPAAC) are a powerful type of bioorthogonal reaction used to elucidate the complex roles of diverse biomolecules in living systems. The strained cyclic alkynes that tag biomolecules are often difficult to access synthetically due to their significant ring strain and low stability. In this research, cobalt-complexed cyclooctyne 2 was synthesized in 7 steps using an intramolecular ring-forming Nicholas reaction strategy. Significant efforts were made to oxidatively decomplex the cyclooctyne using CAN, Fe3(NO)3, and Me3NO, but ultimately no decomplexed product was isolated. All three decomplexation methods were successfully performed on linear alkynes, suggesting that the significant ring strain and resulting instability of the desired cyclooctyne impedes its formation. To test this hypothesis, cyclononyne 5 was pursued using a similar synthetic route, however the key ring-closing Nicholas reaction unexpectedly failed at forming the cobalt-complexed cyclononyne. Further explorations of this research project will focus on utilizing stronger carbon-based nucleophiles to perform the intramolecular Nicholas reaction, as well as overcoming the significant challenge posed by the final oxidative decomplexation step.

SURF Abstract Submission & Post Program Survey 2020

Name	Tess Goldmann
Year of Graduation	2022
SURF Advisor	Marney Pratt, Biological Sciences
SURF Field of Study	Biology (Ecology)

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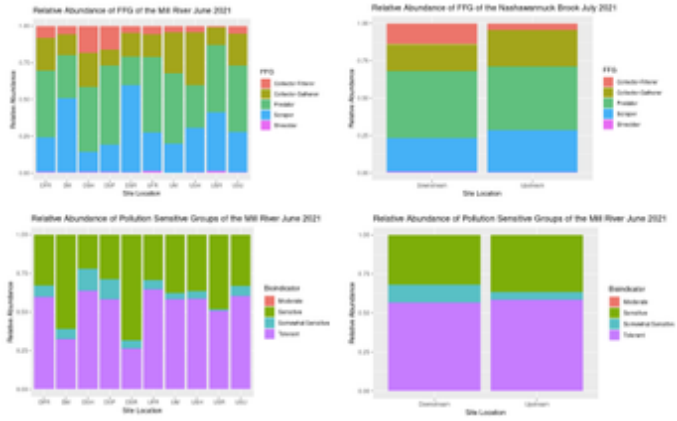

Title of Abstract/Research

Macroinvertebrates as a measure of river health: examples from two river environments in Northampton, Massachusetts.

Please type your abstract below.

Aquatic macroinvertebrates serve as important bioindicators of river health, and an understanding of population, diversity, and population dynamics in macroinvertebrates can offer insight into levels of pollution and sedimentation in river environments. On Smith College campus, the removal of sediment from Paradise Pond affects the environment downriver of the dam, and monitoring macroinvertebrate populations downstream of the dam can help us understand exactly what effects sediment redistribution may be having. The goal of this lab was to collect, identify, and count macroinvertebrates found upstream and downstream of Paradise Pond in the Mill River, in order to contribute to Professor Pratt's long term project monitoring the effect of sediment redistribution in the pond on the health of the Mill River, by comparing downstream sites to locations upstream of the dam, and acquiring data that can be compared to data from previous years from the Mill River. Our team conducted work in the field in order to collect macroinvertebrates and water quality data, then identified and counted the macroinvertebrates collected in 2021. Additionally, we identified macroinvertebrates collected in 2020 that could not be identified due to the COVID pandemic.

The team also developed, tested, and implemented a new study at Nashawannuck Brook, at the former Pine Brook golf course in Northampton. This location is currently undergoing ecological restoration, and an understanding of existing macroinvertebrate communities may influence the restoration decisions the team involved in that project may make, as well as serving as a baseline to compare future samples in the brook to. This project taught the group important skills regarding experimental design, as well as how to effectively communicate results and data to outside groups.

While the majority of the data collected here will be analyzed in comparison to previous years once the data from 2020 has finished being processed, we were able to see patterns between upstream and downstream locations when looking at the functional feeding group and pollution sensitivity of the organisms collected. Upstream and downstream locations had distinct community structures and macroinvertebrate populations that were also distinct from populations in the Nashawannuck Brook, reflecting the difference in health between these environments. Data from the Nashawannuck Brook and Mill River will be further analyzed by future students in order to understand temporal patterns and the effect of anthropogenic interference on river environments.

SURF Abstract Submission & Post Program Survey 2020

Name	Andrew Turgeon
Year of Graduation	2022
SURF Advisor	Caitlin Shepherd, Psychology
SURF Field of Study	Psychology

Title of Abstract/Research Impulsivity Moderates The Relationship Between ADHD and Bulimia Symptoms in US College Students

Please type your abstract below.

Past studies have demonstrated a relationship between inattentive attention deficit hyperactivity disorder (ADHD) symptoms and bulimia nervosa (BN) symptoms. Impulsivity, most notably attentional and motor, may play a role as previous research demonstrates heightened levels for those with either ADHD or BN symptoms. Few studies have directly examined how different impulsivity factors may impact the connection between these symptoms. Furthermore, the majority of studies have focused on women and/or clinical populations. The current study examined impulsivity as a moderator between ADHD and BN symptoms in a diverse sample of US college students. This population may be at increased risk for disordered eating and ADHD symptomatology; thus, research is needed to identify potential intervention targets. We hypothesized that attentional and motor impulsivity, but not nonplanning, would moderate the relationship between inattentive ADHD and BN symptoms. Finally, we hypothesized that impulsivity would not moderate the relationship between hyperactive/impulsive ADHD and BN symptoms.

The study found that only attentional and motor impulsivity moderated the relationship between inattentive ADHD and BN symptoms. For the attentional impulsivity model, only the interaction term was a significant predictor. For the motor impulsivity model, motor impulsivity and the interaction term were significant predictors. For both attentional and motor impulsivity, the association between inattentive ADHD and BN symptoms was only significant at moderate and high levels. Nonplanning did not emerge as a significant moderator of this relationship, nor did any of the three factors of impulsivity moderate the relationship between hyperactive/impulsive ADHD symptoms and BN symptoms.

Findings of the study indicate that the relationship between inattentive ADHD and BN symptoms is stronger at moderate and high levels of attentional and motor impulsivity. This study contributes to literature suggesting that impulsivity may be a transdiagnostic correlate for ADHD and BN symptoms. Replication of these findings would provide support for using interventions that target attentional and motor impulsivity for college students with inattentive ADHD and BN symptoms. Findings from this SURF project will be submitted as a poster presentation proposal to the American Psychological Association 2022 conference.

SURF Abstract Submission & Post Program Survey 2020

Name	Wumei Blanche
Year of Graduation	2022
SURF Advisor	Laura Katz, Biological Sciences
SURF Field of Study	Evolution and Genetics

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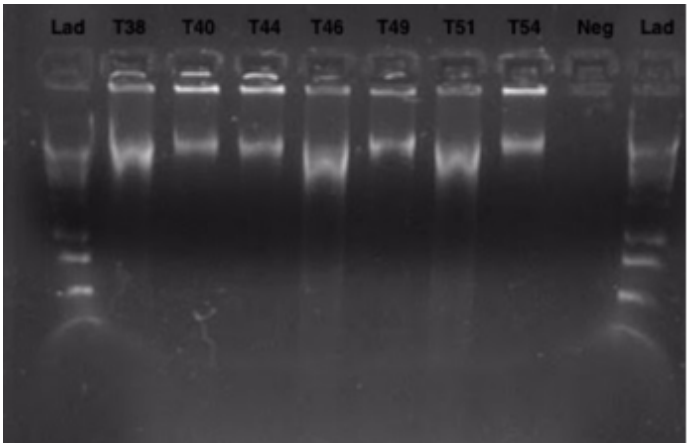

Title of Abstract/Research

Exploring genome architecture and nuclear life cycles in uncultivable ciliate species

Please type your abstract below.

Ciliates are characterized by their nuclear dualism: the presence of a somatic macronuclei and germline micronuclei. The large polyploid macronucleus is expressed during vegetative growth, determines cell phenotype, and is responsible for cell proliferation. In contrast, the small diploid micronucleus is transcriptionally inactive but contributes to the formation of new macronuclei. During cell division, the micronucleus divides by mitosis while the macronucleus undergoes amitosis to produce two daughter nuclei. A ciliate's distinct nuclear architecture emphasizes the importance of analyzing this species' genome widely.

In order to investigate these distinctions, ciliates with extensively fragmented genomes such as Chilodonella uncinata, Halteria grandinella and Loxodes sp. were sampled and picked from Scuzzy Bucket, a vegetative waste bucket located in the Smith College Lyman Plant House and Conservatory, and Hammond Pond, in Goshen, Massachusetts. Three different wet lab procedures were executed on these samples with the goal of isolating DNA and RNA for further sequencing as well as staining for microscopy visualization. DAPI, a fluorescent stain that hybridizes to DNA, was applied to Chilodonella uncinata samples to illuminate cell nuclei and overall cell morphology. Following staining, these samples were further visualized using laser confocal scanning microscopy, a technique used to increase optical contrast of cell contents.

In addition to visualization, DNA and RNA were isolated from Halteria grandinella and Loxodes sp. samples. Whole genome amplification (WGA), purification and quantification confirmed the presence of usable genomic material for further sequencing. As visualized by the gel in Figure 1, promising DNA amplicons of varying size indicated sufficient information for more analysis and contamination assessment. In addition to DNA, total RNA was extracted and purified on a single Chilodonella uncinata cell. While the next step, quantification, has yet to be completed, this procedure is expected to distinguish between the presence of ciliate genome content and symbiont hologenomes. Moving forward, I will use an in-house bioinformatic pipeline to assess the quality of these amplicons for further understanding of these ciliates' nuclear architecture. Additionally, I plan to sample other uncultivable ciliates, such as Suctorians for an expansive overview of genomic diversity across the clade.

Figure 1. Gel of successful Whole Genome Amplification (WGA) of seven isolated cells: five (T38-T46, T54) Halteria grandinella and two (T49-T51) Loxodes sp. Negative control (Neg) and 100 bp ladders (Lad) at each side.

SURF Abstract Submission & Post Program Survey 2020

Name	Emma Sharifi
Year of Graduation	2023
SURF Advisor	Laura Katz, Biological Sciences
SURF Field of Study	Shell-Building Testate Amoebae

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

Figure 2. Heleopera consuming an *H. papilio*. Scale bar = 50µm

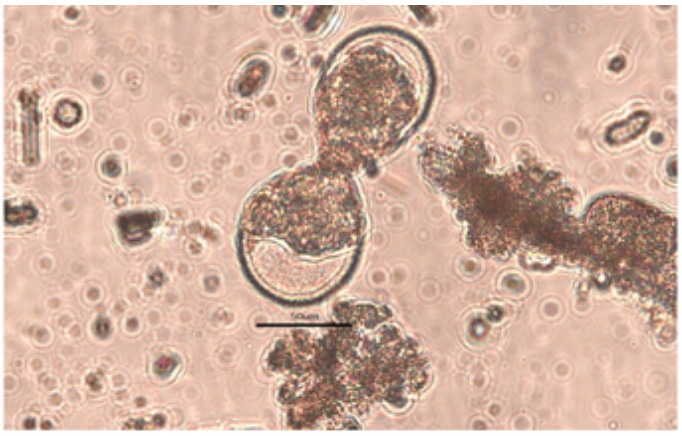

Figure 1. Late stage dividing Nebela. Scale bar = 50µm.

Title of Abstract/Research

Determining genes involved in Arcellinida shell-building processes

Please type your abstract below.

Arcellinida are a group of testate amoebae that are highly understudied, despite their important role as bioindicators for the health of the environment. Found in freshwater bogs, Arcellinida can be identified by their (typically transparent) tests, or shells, and their pseudopods, which extrude from the aperture of the test and are used to capture prey. When Arcellinida divide, they build a test for their daughter cell.

My project included a literature review on the documented elements of Arcellinida cell division. Heleopera, for example, consume shelled amoeba via phagocytosis and store the silica plates of its prey in its aperture. Once it is time to form the test of a daughter cell, the cytoplasm of the parent cell transfers the stored silica plates to create the new test. While the morphological steps of shell-building have been somewhat identified, the genetic factors that motivate it are undetermined. Therefore, the goal of my project is to sequence the transcriptome of dividing Arcellinida to determine which genes are being expressed or upregulated during the shell-building process.

To extract the transcriptomes of dividing cells, samples of moss were first collected from local New England freshwater bogs, then made into plates and examined using light microscopy. Once an Arcellinida was identified, it was isolated from its community, photographed (examples below), frozen, and run through Whole Transcriptome Amplification (WTA). This process helps for the identification of differently expressed genes (Tomlins, 2006). A handful of suspected dividing cells were also identified and amplified. My next step in the project is sending the samples for Illumina sequencing, which helps characterize the genome in preparation for tree-building and assessment of any novel genes that may be included in replication. In the future of the project, I hope to capture Arcellinida at various stages of

division so that when they are sequenced, the genes upregulated in each specific stage of division can be identified. One bioinformatic analysis I will run in the future is PhyloTOL: a phylogenetic pipeline used for creating trees from high-throughput sequencing data (Cerón-Romero et al., 2019). After running the transcriptomes through PhyloTOL, groups of genes (OGs) that are suspected to be involved in shell-building can be used with PhyloTOL to generate trees. Using a Python script created in-house, these trees will be color-coded and examined to see which of the candidate genes may be upregulated during specific stages of division.

SURF Abstract Submission & Post Program Survey 2020

Name	Mika Holtz
Year of Graduation	2023
SURF Advisor	Lisa Mangiamele, Biological Sciences
SURF Field of Study	Biological Sciences/Neuroscience

Please type your abstract below.

This summer, I trained myself in the computational skills required for differential gene expression analysis (DE analysis). This includes cleaning raw RNA-seq reads, performing gene quantification, and running DE analysis. I learned how to use Unix and relevant command-line tools, and I learned how to use DE analysis R packages. I used the publicly available raw data and assembled transcriptome from Fischer and O'Connell 2020, who studied DE in poison frog brains at different parental care stages, and followed their procedure to practice DE analysis. All of this was in preparation for analyzing my own RNA-seq data of the leg muscle, spinal cord, brain of Staurois parvus, to learn more about the genetic basis of its unique foot-flagging behavior. The extracted RNA from these tissues were being sequenced over the summer, and I hope to work with the raw data this school year and begin my Honors thesis in the spring. My work this summer also was towards providing a guideline for future members of the lab to conduct their own DE analysis projects, to further study the genetic basis of the foot-flagging behavior.

References:

Fischer EK, O'Connell LA (2020) Hormonal and neural correlates of care in active versus observing poison frog parents. Hormones and Behavior 120:104696.

SURF Abstract Submission & Post Program Survey 2020

Name	Sarah Miller
Year of Graduation	2024
SURF Advisor	Niveen Ismail, Engineering
SURF Field of Study	Engineering

Please type your abstract below.

The degradation of clean freshwater sources due to microbial pollutants has adverse effects on human health and the environment. Best Management Practices (BMPs) are engineered pollution-control systems that supplement traditional water treatment methods with alternate filtrative, vegetative and structural practices. A potential addition to bioretention basins, a type of BMP, is fungal mycelium that operates as a biologically active filter. Mycelium is the vegetative body of fungi and is known to secrete antibacterial enzymes. Previous research has indicated through permeability and resiliency testing that Pleurotus ostreatus could potentially inactivate Escherichia coli present in contaminated water. This research provides a systematic approach to determining and testing conditions to increase E. coli inactivation using mycelium. Experiments were conducted using E.coli K-12 and Pleurotus ostreatus fungal mycelium inoculated on sawdust. EPA method 1602 was used to quantify E. coli colonies in the samples taken at set time-points throughout the experiment. Through the experimentation process we assessed the capacity of used fungal mycelium blocks to remove the microbial pollutant (E. coli) from water during simulated storm events over time. The storm events were clustered in 2-4 days with drying periods of 5-8 days in between to investigate the capabilities of the packed fungal mycelium columns in long term usage. We consistently observed 1 log additional removal of E. coli by the columns containing mycelium for the first seven storm events in comparison to control columns. However, in the remainder of the storm events, the mycelium columns did not remove more E. coli than the control column that contained sawdust, soil, and sand. These results indicate the mycelium growth was not maintained during longer experimentation durations. It appears that mycelium growth occurred during the first 3 storm events, but there was little to no additional mycelium growth after that. The conditions in mycelium columns were not conducive to mycelium growth which we hypothesize impacted the performance of the mycelium columns over time.

SURF Abstract Submission & Post Program Survey 2020

Name	Vivienne Maxwell
Year of Graduation	2022
SURF Advisor	Gregory de Wet, Geosciences
SURF Field of Study	Paleoclimatology / Statistics

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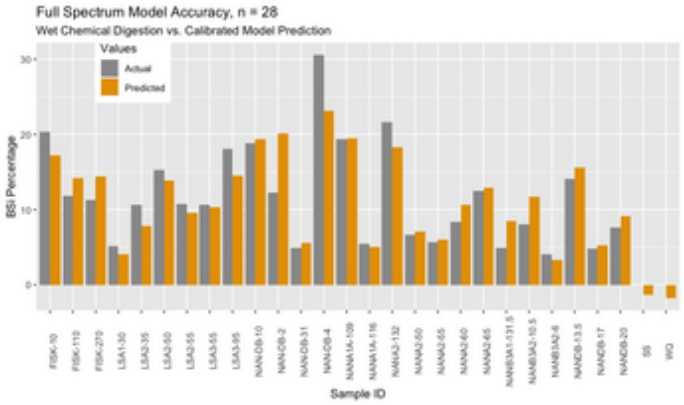


Title of Abstract/Research

Calibration Model to predict BSi percentages in lake core samples from the high arctic

Please type your abstract below.

High-resolution proxies for temperature–such as biogenic silica (BSi) and total organic carbon (TOC)–are preserved in lake core samples. In High Arctic settings, higher levels of BSi and TOC indicate warmer temperatures and are helpful in reconstructing past climates and understanding temperature variations over large periods of time (McKay et al., 2008). A labor intensive wet chemical digestion method is most commonly used to measure percentages of BSi and an Elemental Analyzer is often used to measure TOC. However, these methods are time-consuming, costly and prone to human error (Hurd, 1972; DeMaster, 1981, 1991; Eggiman et al., 1980; Mortlock and Froelich, 1989; Müller and Schneider, 1993; Landén et al., 1996).

Recently, an alternative method employing a Fourier Transform Infrared (FTIR) Spectrometer has been applied to lake core sediments and initial results suggest it to be a more efficient technique for measuring BSi and TOC (Vogel et al., 2008; Rosén et al., 2010; Rosén et al., 2011). Infrared radiation (IR) excites molecules that are made up of covalent bonds (Vogel et al., 2008). Depending on the molecular structure, IR radiation absorbance will differ at various wavelengths, and as a result the absorption spectra represents the chemical composition of a sample. The limitation, however, is that FTIR yields BSi and TOC measurements in terms of spectral absorbance peak area rather than percentages.

In this research project, we developed a partial least squares (PLS) regression model (e.g. Mevik and Wehrens, 2020) to predict percentages of BSi based on FTIR absorbance spectra. The initial model was coded in R and developed using 28 lake core samples from Greenland. Residuals were calculated to determine whether more accurate percentages were predicted over the entire absorbance spectra or over individual spectra intervals. A new set of 100 samples from Alaska will be run through the Greenland model to determine the model's accuracy in predicting percentages of BSi. The next step is to develop an Alaskan model based on the 100 Alaskan samples.

SURF Abstract Submission & Post Program Survey 2020

Name	Arshiyan Alam Laaj
Year of Graduation	2023
SURF Advisor	Maren Buck, Chemistry
Secondary SURF Advisor	Alexis Ziemba
SURF Field of Study	Chemistry

Please type your abstract below.

Projects in the Buck lab focus on the synthesis and characterization of the reactive polymer poly(2-vinyl-4,4-dimethyl azlactone) (PVDMA) (1). Side chains in PVDMA can readily react with primary amines, primary alcohols, or thiols to form hydrogels which can then be functionalized with different proteins and peptides. These experiments can form the basis of the exploration of PVDMA hydrogels as nerve guidance conduits (NGCs) which create a bridge between damaged nerve endings and aid nerve regeneration. The goal of my project is to make a self-rolling PVDMA hydrogel that can be functionalized with proteins and other molecules that facilitate neuron growth in vitro.
During SURF, I fabricated PVDMA-Jeffamine 600 hydrogels of 25%, 50%, and 75% crosslinking density and carried out multiple kinetics experiments with time points that ranged from 2.5 minutes to 3 days to determine when gelling was complete. FTIR spectroscopy was used to characterize the time taken for the hydrogels to fully crosslink. Around 2 hours post-mixing of reagents, all hydrogels were fully gelled regardless of crosslinking density. Using the gelling data from the previous experiments, I set out to work on the swelling properties of hydrogels. I fabricated several hydrogel bilayers with varying cross-linking densities (10%, 25%, 50%, and 75%) and crosslinkers (Jeffamine 600, Jeffamine 2000). The bilayers were fully functionalized with newly synthesized 2-(2-(2-Methoxyethoxy)ethoxy) ethanamine (mTEGa) to increase the hydrophilicity of the gels and allow the gels to swell by absorbing water and roll. The gels did not fully roll during the course of SURF. However, new data from the following experiment shed light on why. For gels to roll, the outer layer needs to absorb more water than the inner layer to cause the bilayer to roll up. In the last experiment, the ratio of the mass of water absorbed by mTEGa functionalized gels (Jeffamine 600: 25%, 50% and 75%; Jeffamine 2000: 10%, 25%, 50%) and freeze-dried mass of the same gels, Q, was measured. The data showed that at their lowest crosslinking density, both Jeffamine 600 and 2000 crosslinked hydrogels absorbed the same amount of water. However, for higher crosslinking densities, Jeffamine 600 gels absorbed more water. Our previous assumption that layers with longer crosslinkers automatically absorbed more water was proven wrong. The next goal is to figure out which bilayer combination will allow the gels to roll, and then to test the cell biocompatibility of these gel bilayers.

(1) M.; Anex-Ries, Q.; Carroll, A. L.; Garcia, A. P.; Hindocha, P.; Buck, M. E. Fabrication, Chemical Modification, and Topographical Patterning of Reactive Gels Assembled from Azlactone-Functionalized Polymers and a Diamine. J. Polym. Sci. Part -Polym. Chem. 2017, 55 (19), 3185–3194. https://doi.org/10.1002/pola.28664.

SURF Abstract Submission & Post Program Survey 2020

Name	Emma Whittemore
Year of Graduation	2024
SURF Advisor	Michael Barresi, Biological Sciences
SURF Field of Study	Developmental Biology

Please type your abstract below.

Throughout neurogenesis, many different cells migrate in and around the nervous system to aid in constructing the brain. In zebrafish (danio rerio), looking at commissures in the forebrain, where neurons cross between the two hemispheres, provides an important setting to understand how the brain is built. Neural Crest Cells (NCC) are one cell population that migrates anteriorly through the forebrain and have even been shown to re-enter the forebrain, possibly contributing to the patterning of other cells near these commissures (Schnabl 2020). Because these NCCs must be further investigated, the Barresi lab seeks to identify another gene marker to track these cells later once a known marker, sox10, has been downregulated. Meteorin (metrn) and meteorin-like (metrnl) arose as two possible candidate markers through transcriptomic analysis for us to investigate this summer. The work that followed pertained to tagging proteins or mRNA transcripts of these cells and genes, respectively, to determine if NCCs do express metrn and/or metrnl. In situ hybridizations were performed on 16, 18, 20, and 24 hpf embryos to label either metrn or metrnl mRNA transcripts, though meteorin proved more successful. Observed expression patterns of meteorin-like were non-discrete, leading to the synthesis of new probes for subsequent in situs. For visualization purposes, some embryos were labelled with NBT-BCIP, a color precipitate that allows for imaging of embryos with the metrn mRNA transcript or the metrnl mRNA transcript. Other embryos were labelled with fast red, a fluorescent red precipitate, and upon a successful in situ, immunocytochemistry (immunos) on sections was performed. These immunos used fluorescent antibodies to tag the proteins zrf1 (gfap), a radial glia marker that outlines the end feet of radial glia, and sox10, a known Neural Crest Cell marker. As a result of these immuno and in situ combinations, we saw successful labeling of NCCs in the periphery of the forebrain, radial glia outlining the forebrain itself, and metrn and metrnl expression. Imaging will continue in the fall and then analysis will begin to determine the level of colocalization between NCCs and metrn or metrnl. Once the new light sheet microscope is installed and fully functional, images can be obtained to render a 3-dimensional model of the forebrain and expression patterns of our cells of interest.

SURF Abstract Submission & Post Program Survey 2020

Name	Jailene Gonzalez
Year of Graduation	2022
SURF Advisor	Laura Katz, Biological Sciences
SURF Field of Study	Biological Sciences

Please type your abstract below.

The majority of eukaryotes are single-celled microbes, referred to as protists, many of which remain understudied because they cannot currently be cultivated. Here, I survey protist diversity within phytotelmata (water cavities, including pitchers) of Nepenthes tropical pitcher plants. My focus is on the diversity of the SAR (Stramenopiles, Alveolates, and Rhizaria) clade that includes photosynthetic lineages (e.g. diatoms, dinoflagellates), parasites (e.g. apicomplexans, oomycetes), heterotrophs (e.g. ciliates, most Cercozoa), as well as many other interesting and uncultivable lineages. I use SAR-specific primers designed to amplify a portion of the SSU-rRNA gene to characterize community diversity in pitchers sampled from the Nepenthes pitcher plants at the Smith College Lyman Plant House and Conservatory. Pitchers were sampled from different life stages to investigate whether unopened pitchers are microbially sterile or, instead, are seeded with a microbial community from their parent plant or environment. I aim to compare differences in SAR communities among closed juvenile, recently-opened adults, and open mature pitchers. My preliminary results suggest that juvenile unopened pitchers harbor a less abundant and sometimes undetectable SAR community while open adult and mature pitchers harbor well-established and diverse SAR lineages.

In addition, I am also interested in studying the activity and the function of the entire micro-eukaryotic community nested within the phytotelmata of these pitcher plants. I am looking into this by conducting a metatranscriptomic study which creates a library of the mRNA of the microeukaryotes living inside of these pitchers in order to identify what is living inside of them. This process will allow me to look at a subset of genes that are transcribed or expressed by the active community inside of our samples. The importance of this study in relation to the aging pitcher plant study I am conducting is that this new metatranscriptomics approach will allow me to capture the microbes that our SAR-specific primers do not capture and give a more accurate representation of the pitcher plant microbiome.

SURF Abstract Submission & Post Program Survey 2020

Name	Margaret Stoffer
Year of Graduation	2023
SURF Advisor	L. David Smith, Biological Sciences
SURF Field of Study	Biological Sciences (Marine Ecology)

Title of Abstract/Research Foraging Behavior of H. Sanguineus (Asian Shore Crab) on native snail prey

Please type your abstract below.

Anthropogenically driven phenomena continue to plague the world's oceans. The Gulf of Maine, spanning from Cape Cod to Nova Scotia, is a system exhibiting two major ways in which humans have impacted oceans: rising temperatures as a result of climate change and the spread of invasive species. This summer, our team assisted master's student June Arriens with data collection for her thesis. Arriens' topic of study includes intertidal predator-prey relationships in the Gulf of Maine and how they are affected by increasing temperatures, invasive species, and predator sex. The species involved in our experiments included Hemigrapsus sanguineus (Asian shore crab), an invader from East Asia first recorded in the United States in the 1980's, and the native snail Littorina obtusata (smooth periwinkle). Our team conducted three different experiments: a determination of prey critical size (the largest snail a crab can crush), prey choice (crabs fed snails of multiple sizes) to determine preferred size, and no-choice (crabs fed all one size snail) to assess feeding rate. . The basic outline of these experiments consisted of collecting Hemigrapsus of both sexes across a size range as well as L. obtusata across a size range, acclimating the crabs and snails to randomly assigned temperature treatments (normal and elevated to reflect changing temperatures), determining the critical size by feeding crabs progressively larger snails until they could not be crushed, determining which size snails the crabs prefer to eat given a choice, then observing how many snails of a specific size a crab can crush within a given time period. Results from these experiments could provide further insight into how invasive predators can alter native prey population structure as well as how climate change will continue to affect this system of study. In addition, few foraging studies have been conducted using female crabs.

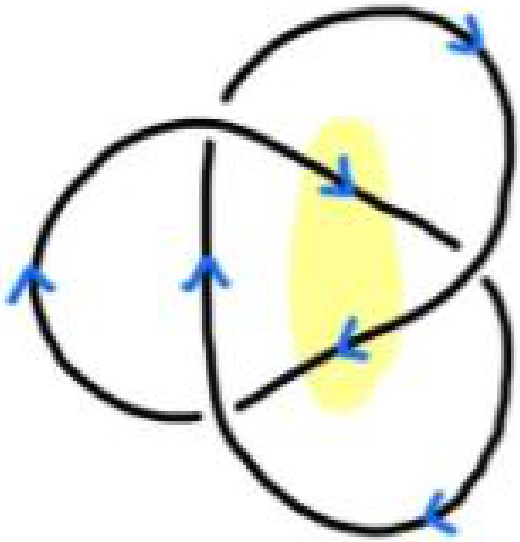
In addition to these experiments, we conducted two separate studies to understand crab foraging behavior and crushing strength. In the first study, we set up a controlled filming project to capture preliminary data on foraging habits of H. sanguineus, such as handling method, handling time and rate at which a given quantity of L. obtusata were eaten. Crabs were acclimated in an aquarium with identical conditions (size, substrate) to the filming tank and kept at room temperature (about 19°C) under fluorescent lights with a photoperiod of about 9 hours. After at least 24 hours of acclimation, crabs were taken out one by one for filming periods of 1 hour each
in darkness to maximize foraging activity. Five snails under their critical size (determined from Arriens data) were added to the tanks. Analysis of foraging techniques (e.g., which claw was dominantly used; if the snails were crushed or probed, how quickly they were eaten) will provide information about the efficacy of H. sanguineus as a predator in the Gulf of Maine. This experiment was also unusual in its comparison of female and male crabs to determine differences between sexes. These observations will inform future experimental and field-based projects that monitor the ongoing takeover of H. sanguineus in the rocky intertidal.

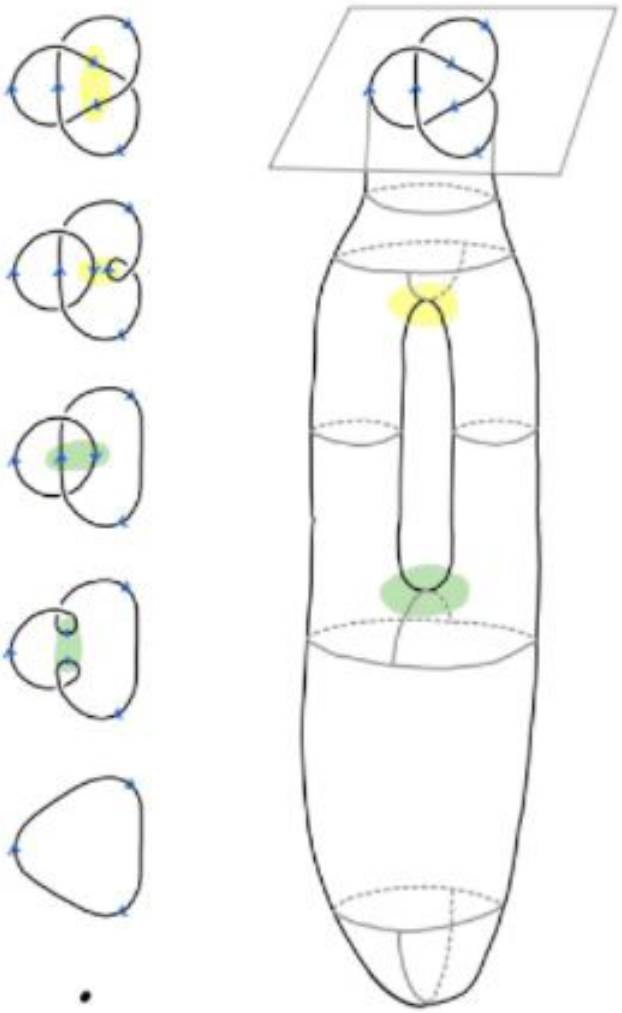
In the second study, we tested the absolute crushing force H. sanguineus exerted on snails. The crushing force experiment was conducted by having the crabs pinch a pair of small metal rings connected to a force transducer. The rings were separated to a distance of 30% of the crab's claw gape to mimic force used in the natural environment. By calibrating the transducer with weights from 10g to 200g, we were able to compare the mV of force measured by the transducer with the weights and determine the grams of force the crabs were able to exert. While the crabs were sometimes reluctant to pinch the transducer, this experiment provided a framework for understanding how much force the crabs are capable of exerting, and this research will be refined to create a more consistent format for measuring crab crushing force.

SURF Abstract Submission & Post Program Survey 2020

Name	Annika Gonzalez-Zugasti
Year of Graduation	2023
SURF Advisor	Patricia Cahn, Mathematics and Statistics
SURF Field of Study	Mathematics > Topology > Knot Theory

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





Title of Abstract/Research p-Colorability of Surfaces Bounded by Knots

Please type your abstract below.

A knot in mathematics is similar to a knot in real life. Imagine that you take a piece of string and tangle it up. Then, glue the two ends of the string together. When we draw a knot on paper, we draw a diagram

with over-under crossing information. However, there are a couple more rules to these theoretical knots. A knot is an embedding of the circle in 3D space. An embedding simply means that the circle does not touch itself anywhere.

[Image 1]

A knot diagram can be deformed to another knot diagram of the same knot. In order to deform a knot, we use the three Reidemeister moves to assure that our knot does not pass through itself while being deformed, because that would result in a completely different knot. There are knot invariants which are numbers that can be used to tell different knots apart. One of the most important invariants for our purposes is the 3-coloring and, by extension, the p-coloring. The 3-coloring assigns 3 different colors to a knot, using the following rules: each arc (meaning if you follow a strand of the knot, the arc will end at a crossing where that strand is under) is assigned a color, at each crossing the 3 strands either have to be all the same color or three different colors, and at least 2 of the colors must be used in the entire diagram. If the determinant is divisible by 3, then it is 3-colorable. The p-coloring is a similar invariant where the “3” is replaced by any prime number p. However, for the p-coloring, at each crossing, the sum of the two bottom strands must be equivalent to twice the upper strand mod p.

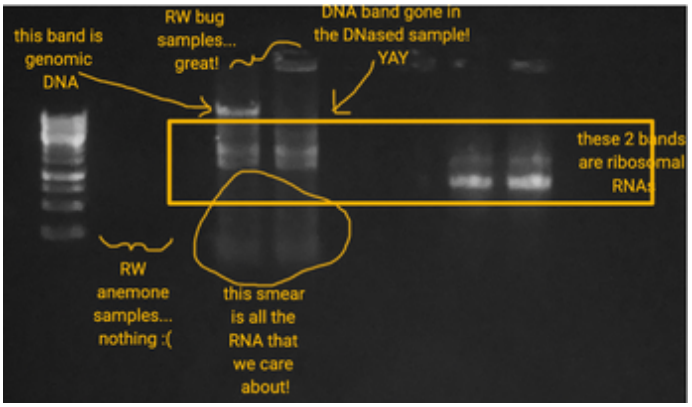
We studied surfaces bounded by knots, where the surface lies in the 4th dimension. The 4-genus of the knot is the minimum number of holes in any such surface. These surfaces are defined by the amount of births, deaths, and saddles they have, which can be used to compute the 4-genus. A p-coloring of the knot will extend over the surface when the saddle moves can be applied using only strands that share the same color. We then explored for which knots the minimal 4-genus and the minimal p-colored 4-genus are the same.

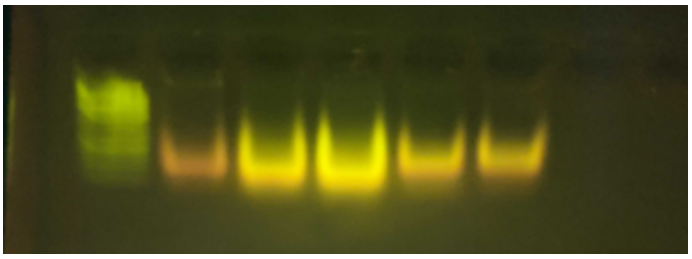
[Image 2]

SURF Abstract Submission & Post Program Survey 2020

Name	Joanne Moseley
Year of Graduation	2022
SURF Advisor	Rachel Wright, Biological Sciences
SURF Field of Study	Biology

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





Title of Abstract/Research

Exploration, Troubleshooting and Setup of Future Research Methods

Please type your abstract below.

My goal for the first half of SURF this summer was to collaborate with fellow SURF participant Giovanna Sabini-Leite in analyzing frozen samples from her thesis on effects of light and nutrient stress in the sea anemone Exaiptasia pallida so that those samples could be sent off for sequencing. We performed several useful physiological assays on the thesis samples that gave more insight into the relationship between the anemone and its algal endosymbionts, but we struggled to get enough quality RNA from the samples to finish the sequencing preparation steps. However, our experimentation with the thesis samples and test anemone and bug samples indicated that the RNA isolation protocol worked with a different sample storage method, resulting in the development of an effective protocol for future use in the lab.
In the second half of the SURF period, my goal was to continue this troubleshooting process to develop a consistent protocol from anemone tissue harvesting to sequencing for future research use in the lab. An additional goal was to set up an anemone spawning protocol and to test that protocol in order to hopefully achieve a successful spawning that would yield anemone larvae for research purposes. While the anemones did not spawn during this 28-day cycle, I now know how to plan for and maintain spawning anemones, and this protocol will help lead to the future production of anemone larvae in the lab. Lastly, another goal throughout SURF this summer was to gain more knowledge of the literature, and to work on literature research and figure-making skills.

Figure 1. The first of a series of test RNA isolations using anemone samples and bug samples taken from bugs found on campus. This test was successful for the bug samples, but not for the anemone samples, so we repeated this test many more times with slightly different protocols in order to find one that worked consistently for anemones.

Figure 2. This figure shows a gel which indicates that we successfully managed to get reliable, high-quality RNA from our new RNA isolation protocol resulting from our protocol experimentation, meaning we could continue on to troubleshoot the next steps towards sequencing. The second lane is RNA from one frozen anemone, the third is 2 frozen anemones, fourth 3 frozen anemones, fifth another single frozen anemone, and sixth a single fresh anemone.

SURF Abstract Submission & Post Program Survey 2020

Name	Christine Wu
Year of Graduation	2024
SURF Advisor	Amy Rhodes, Geosciences
SURF Field of Study	Geosciences

Please type your abstract below.

Vernal pools are wetlands that are present in the late winter through spring due to recharge from snowmelt and seasonal precipitation. In New England, they typically do not persist through summer and fall when monthly rainfall totals decline. The MacLeish Field Station contains several vernal pools, some of which are connected by streams. The intention of this project is to further understand the hydrology that supplies water to the vernal pools at MacLeish and the factors affecting their water chemistry. Geochemistry studies aspects such as the grain size of sediments, the mineralogy of bedrock and sediments, as well as the sources of water coming from streams, groundwater, or the perched water table. In the field, we examined if the vernal pools contained inlet or outlet streams and walked the lengths of streams to see if the pools were hydrologically connected. We sampled water from the pools and streams and measured the water's temperature, specific conductance, and dissolved oxygen content. After the pools dried up, we dug small soil pits to examine and sample the sediment that underlies the vernal pools. In the lab, we measured concentrations of major cations and anions, dissolved silica, pH, specific conductance, alkalinity, and stable isotope composition. There are high concentrations of silica in the water which suggests the pools are sourced more from the groundwater. Additionally, calcium was largely present at Macleash which is consistent with calcite ($CaCO_3$) weathering which adds calcium and alkalinity. Pyrite (FeS_2) that when weathered increases the level of sulfate and acidity and lowers alkalinity can also explain a large amount of sulfate. Calcium and alkalinity have the highest concentrations in all water samples consistent with calcite weathering. The sulfate and dissolved oxygen concentrations decrease between June and July as the amount of pool water dropped, suggesting that sulfate reduction is occurring. Sulfate reduction to H_2S may occur if dissolved oxygen levels in the pool are low, and this reaction can generate alkalinity. Further study will examine the geochemistry and stable isotope data further to better understand sources of water to these pools. A grain-size analysis will help evaluate soil permeability to address why the pools may develop at different locations in the landscape at MacLeish.

SURF Abstract Submission & Post Program Survey 2020

Name	Rachel Pietrow
Year of Graduation	2022
SURF Advisor	Steve Williams, Biological Sciences
Secondary SURF Advisor	Jessica Grant
SURF Field of Study	Molecular Biology & Genetics

You can find sample abstracts from previous years here.

Title of Abstract/Research	Immunity Gene Knockdown in Aedes

Please type your abstract below.

Mosquitoes serve as vectors for many impactful and debilitating diseases that perpetuate pain and poverty worldwide. A greater understanding of mosquito vector competence, or the ability of a vector to acquire and transmit a pathogen, can help us in our efforts to reduce disease transmission. One component that is crucial to vector competence is an understanding of the immune system of mosquitoes. The ability of the mosquito immune system to fight off viral or parasitic infections impacts its ability to transmit disease effectively. If the immune system of a mosquito is suitably strong enough to fight an infection, it won't serve as a particularly effective vector. Investigating the immune system of Aedes polynesiensis, an understudied species, would give us a deeper grasp of their transmission of dangerous and debilitating diseases such as lymphatic filariasis, dengue and Ross River virus, and how their abilities as infectious agents compare to better-studied species of mosquito.

This summer I focused on designing CRISPR and RNA Interference (RNAi) experiments crafted to target the negative regulators of the immune system of the mosquitoes Aedes polynesiensis and Aedes albopictus. The two negative regulators targeted, Cactus and Caspar, help control two of the major immune system pathways in the mosquito - the Toll and Imd paths. In this way the immune system as a whole would be upregulated and could more effectively target parasites and disease. Hopefully, this would compromise the ability of the mosquito to serve as a vector, leading to a reduction in disease transmission. Eventually, live Aedes polynesiensis mosquitoes infected with the causative agent of lymphatic filariasis, Wuchereria bancrofti, will be modified in this way and studied to see how these gene knockdowns affect infection. Prior to this, Aedes polynesiensis and Aedes albopictus cells will be knocked down in culture to verify the success of the protocol. Double stranded RNA of both Cactus and Caspar must be synthesized for the RNAi experiment. To do this, the genes must be amplified from both the Aedes polynesiensis and Aedes albopictus genomes and a T7 promoter sequence must be added, allowing for transcription of the genes using a T7 polymerase. So far, the T7 promoter sequences have been added to both Aedes polynesiensis and Aedes albopictus Cactus and Caspar. This fall I'll continue the cell culture transfection and verify the success of the RNAi and CRISPR protocols before progressing on to live mosquito transfection.

SURF Abstract Submission & Post Program Survey 2020

Name	Habso Omane
Year of Graduation	2022
SURF Advisor	Virginia Hayssen, Biological Sciences
SURF Field of Study	Biological Science

Please type your abstract below.

Bloom's taxonomy, a learning classification, may assist students in developing higher-order thinking in college-level courses. In Bloom's taxonomy, learning is assessed through various levels; memorization, comprehension, application, analysis, synthesis, and evaluation. We explored the practicality of Bloom's taxonomy by producing worksheets for the course BIO130: Biodiversity, Ecology, and Conservation. Questions within the worksheets contained various verbs outlined in Bloom's taxonomy. The production of the worksheets was intended to assist the BIO130 students in improving the quality of their biology education.

SURF Abstract Submission & Post Program Survey 2020

Name	Rose Evard
Year of Graduation	2023
SURF Advisor	Sarah Witkowski, Exercise and Sports Studies
SURF Field of Study	Exercise & Sport Studies

Please type your abstract below.

Hot flashes (HFs) are sudden sensations of heat throughout the body, and result in increased sweating and heart rate, and flushing of the face and neck. HFs themselves can cause discomfort and decreased quality of life, while increased frequency and severity is indicative of cardiovascular disease risk. Eighty percent of women experience HFs during menopause, which persist for an average of 8 years. Medical interventions to treat HFs often come with unwanted side effects. Physical activity (PA) is anecdotally claimed to reduce HFs, but past scientific reviews have concluded that there is not enough data to determine if there is a relationship. To expand upon the knowledge in the field, we are examining objectively and subjectively reported HFs.

Women aged 40-60 simultaneously wore PA monitors and HF monitors. HF monitors allow for participants to report subjective HFs by button-push, while the monitor records objective HFs through sternal skin conductance which peaks during the body's physiological response to HFs. Objective and subjective HF occurring within 20 minutes of each other were labeled as concordant. Frequencies of HFs per hour were found per participant. Physical activity data was scored with Montoye (2020) wrist-worn reduced training cutpoints, and sleep time not included in sedentary time. Hierarchical models were created for each HF category which included: menopausal stage, HF monitor wear time, PA monitor wear time, hours of sedentary behavior, minutes of light activity, minutes of moderate activity, and minutes of vigorous activity.

95 participants were included in this analysis. 21 were premenopausal, 38 were perimenopausal, 35 were postmenopausal, and one participant did not report their menopausal stage. Mean (+/- SD) objective HF frequency was 0.278 (+/- 0.322), mean subjective HF frequency was 0.142 (+/- 0.180), and mean concordant HF frequency was 0.097 (+/- 0.148). Menopausal stage was significantly associated with subjective (ANOVA, $p = 0.03$) and concordant HF frequency (ANOVA, $p = 0.005$). Concordant frequency was correlated with subjective ($r = .944$, $p < 0.01$) and objective frequency ($r = 0.759$, $p < 0.01$). Subjective and objective frequency were also correlated ($r = .735$, $p < 0.01$). No significant relationships were found in any model. Thus, we cannot reject the null hypotheses that PA and HFs are unrelated. I created a novel methodology in MatLab to examine PA preceding and following a HF. This program will be implemented to further evaluate how acute PA impacts HFs, as opposed to total daily PA.

SURF Abstract Submission & Post Program Survey 2020

Name	Kristin Cirulli
Year of Graduation	2023
SURF Advisor	Nnamdi Pole, Psychology
SURF Field of Study	Psychology

Please type your abstract below.

Psychology is a vast field with endless opportunities and this SURF project helped me dive into some of the many disciplines in order to find which best suits my interests. This summer, I was fortunate enough to work alongside Professors Nnamdi Pole, Annemarie Gockel, and Peggy O'Neill of the Smith College School for Social Work. I helped as a TA with Professor Pole's summer social work class "Evidence Based Practice" by recording attendance in a spreadsheet, reviewing class materials such as supplemental videos for the content, and updating the course Moodle page. I was also given the opportunity to work on a research project with the School for Social Work about Social Justice Conversations. I navigated through unfamiliar softwares Dedoose and LIWC in order to analyze excerpts that the participants had written in response to the questions posed during study. Through Dedoose, I was able to create customized groups that included the excerpts for specific groups at specific points in time in order to best answer the given research question. LIWC is a software that analyzes word usage for various categories, such as emotions or pronouns, within the excerpts. One of the biggest flaws with using LIWC is that it fails to recognize some words, which is detrimental when those words are prevalent to the study. LIWC did not recognize words like race, oppression, and diversity, all of which are especially relevant and important when studying conversations about social justice. In order to remedy this, I was asked to create a custom dictionary to upload into LIWC that would account for and categorize these words that were not accounted for. By doing this, we are able to cater to the research questions and get the desired results. There is still work to be done with the project, so the results are not yet available, but we made incredible progress in this short period of time. This internship gave me a deeper understanding of how much hard work goes into manipulating data in order to be able to interpret and understand it. During my SURF internship, I was able to work with qualitative and quantitative data, do preliminary analyses, navigate unfamiliar software, assist with graduate-level psychology courses, and much more. I am incredibly grateful for the guidance that the advisors and research team provided and for being part of this project.

SURF Abstract Submission & Post Program Survey 2020

Name	Elena Wang
Year of Graduation	2024
SURF Advisor	Glenn Ellis, Engineering
SURF Field of Study	Engineering Education

Please type your abstract below.

Transforming Engineering Education for Middle Schools (TEEMS) is an ongoing project to develop a Next Generation Science Standards-aligned middle school STEM curriculum that encourages early interest in engineering. The curriculum is based on the theory of imaginative education, which fosters students' creativity and curiosity through the utilization of cognitive tools. An integral component of the curriculum is its use of transmedia narratives to immerse students in the content and create an engaging learning environment.

Throughout the summer, I worked on various tasks, including analyzing data, conducting a literature review, and developing resources for classroom use. Our data set consisted of qualitative student responses to an assessment designed to evaluate the effectiveness of our curriculum. I reviewed the responses and collected examples of student language that will be used to define the categories of the assessment's scoring rubric. Additionally, I conducted a literature review of the use of narrative and story in engineering education. I discovered that others have incorporated narrative into curricula in a multitude of ways, but few used the cognitive tools of imaginative education or used narrative as an overarching framework like in our curriculum. Lastly, I worked with the curriculum development team to find videos that will be used as resources for students and to design worksheets for students to use in class. We also began brainstorming ideas for a lesson that is currently under development.

In the upcoming 2021-22 school year, we will be able to resume implementing our curriculum in classrooms throughout the Springfield Public School System. Using the rubric that we have been developing over the summer, we will be able to continue collecting and analyzing data. Furthermore, my work on the literature review will be useful as we prepare to write papers about our project for future publication.

SURF Abstract Submission & Post Program Survey 2020

Name	Jiyun Zhang
Year of Graduation	2022
SURF Advisor	Maren Buck, Chemistry
SURF Field of Study	Chemistry

Please type your abstract below.

Polymer is a substance made up of macromolecules and composed of many repeating subunits, monomers. Each monomer can be functionalized for different purposes. Previously, the protein-polymer conjugation project in Buck lab used poly(2-vinyl-4,4-dimethylazlactone) (PVDMA) with a reactive azlactone functionality to conjugate to the integrin-binding protein. This summer, the focus has been shifted to working with a new polymer called poly(pentafluorophenyl acrylate), poly(PFPA) for one of its exciting properties: high reactivity towards amines. This property can be used when functionalizing poly(PFPA) with N-(2-Aminoethyl) maleimide for reacting with thiol-reactive groups on the targeted protein.

The main goal of this study is to synthesize and functionalize poly(PFPA) and then couple the functionalized polymer for targeted drug delivery applications. The polymer, polyPFPA, was synthesized through a controlled method called reversible-addition fragmentation chain-transfer (RAFT) polymerization. Derivatives of maleimide were synthesized for post-polymerization modification of the polymer, including N-(2-Hydroxyethyl) Maleimide. There is some troubleshooting that needs to be done on synthesizing N-(2-Aminoethyl) Maleimide. Different ratios of N-(2-Hydroxyethyl) Maleimide and hydrophilic methoxy terminated triethylene glycol monomethyl ether (mTEG) had been added onto polyPFPA. The functionalized poly(PFPA) is characterized using F19 nuclear resonance (NMR) spectroscopy. Further protein-polymer conjugation to a unique thiol in the target protein is needed to test the efficiency of the polymer.

Reference:
(1) Li, Y. Site-Specific Protein-Polymer Conjugation for Targeted Cancer Therapy. 77.

SURF Abstract Submission & Post Program Survey 2020

Name	Raina Okonogi-Neth
Year of Graduation	2023
SURF Advisor	Candice Price, Mathematics and Statistics
SURF Field of Study	Mathematics

Please type your abstract below.

Using the text Much Ado About Nothing (MAAN) by William Shakespeare, we explored the ways in which one could apply network theory to understand thematic connections between works of literature.

Analysis of MAAN reveals themes that persist throughout literature: love-hate relationships, trickery, scandal and reputation, sexual purity. Implementation of this project would require further textual analysis of the play to identify specific details in the execution of each selected theme. In order to compare another work to MAAN (or another source text), one would score that work on two variables: the number of themes replicated and the fidelity with which said themes are replicated. Using these two variables as two-dimensional coordinates, the new work would be plotted on a plane to show relative similarity to or variation from the source text.

Applying this method to direct adaptations (MAAN has several) would provide a sample of highly similar works. Further network theory analysis of a group of adaptations could reveal illuminating trends in what aspects of the source material authors are interested in recreating over time. However, applying this method to unrelated works could also yield interesting results. One application of this could be to measure the efficacy of book recommendation systems.

This method also has implications for understanding author influence. With a work like MAAN, commonly accepted to belong to the literary canon, one can assume that future authors are at least passingly familiar with the text's themes. Thus, this method allows one to identify a collection of thematically similar works which, it could be argued, are influenced by the source text. Applying further analysis to this group of works, one can create a genealogy tree of author influence wherein past authors can be said to influence future authors.

Future researchers could implement this project by scoring a group of comparison works for specific themes. Given the subjective nature of literary analysis, it is likely that a large sample size of perspectives would be required to do this accurately. Future researchers could recruit a group of participants to score comparison works according to a prepared survey, then average those scores to obtain final scores for each work. Future researchers could then make their own claims as to the implications of the detected patterns for the thematic legacy of the source text.

SURF Abstract Submission & Post Program Survey 2020

Name	Elinor Sterner
Year of Graduation	2024
SURF Advisor	Laura Katz, Biological Sciences
SURF Field of Study	Biology

Please type your abstract below.

My goal for SURF was to make progress on various projects related to the transcriptomics, evolution, and ecology of Foraminifera, a clade of shelled amoeba living in largely marine environments. Beyond this, I also worked on a manuscript about ploidy levels among eukaryotes, which involved reading an array of primary literature and synthesizing it into a relevant and concise paper. The study of the evolution of foraminifera is significant since past research has relied on morphological characteristics, thus the projects I worked on used rDNA sequences and whole transcriptomes.

First I contributed a project focusing on the epibiotic relationship between foraminifera and animals to identify which foram species are present on the surfaces of animals in marine fish tanks at Smith. We found sequences matching with foram species on various animals, including clams, crabs and snails. Additionally, when fake shells were placed in the tank and taken out after different times over a 21 day period, the longer the shells were in the tank the more indicators of forams we found. This shows that foraminifera can colonize surfaces within short periods of time. A significant portion of my time on this project was dedicated to comparing two bioinformatic methods, SWARM and DADA2, which group sequences by similarity, showing abundance of each species found. We identified a few differences between the two, one being the sensitivity. SWARM grouped more sequences into each cluster that represents one hypothesized species whereas DADA2 was more selective, grouping fewer sequences into each cluster.

Second, I worked with a bioinformatic pipeline developed by the Katz lab to keep our database current with new transcriptomes from other labs. Ultimately, this will strengthen our tools and allow us to learn more about gene expression, codon usage, and phylogeny of foraminifera. In my case, it will contribute to a project focused on codon bias in the clade Tubothalamea. Initial results show that this clade has extreme bias towards AT nucleotide base pairs, potentially indicating that they have translational machinery different from other foraminifera. The results from this study have and will continue to reveal more about the evolution of this understudied clade.

SURF Abstract Submission & Post Program Survey 2020

Name	Elena Grandbois
Year of Graduation	2022
SURF Advisor	L. David Smith, Biological Sciences
SURF Field of Study	Marine Invertebrates

Title of Abstract/Research Predator/prey interactions between Hemigrapsus sanguineus and Littorina obtusata.

Please type your abstract below.

ABSTRACT
Elena Grandbois, Sophie Schneider, and Maggie Stoffer
Professor L. David Smith

Anthropogenically driven phenomena continue to plague the world's oceans. The Gulf of Maine, spanning from Cape Cod to Nova Scotia, is a system exhibiting two major ways in which humans have impacted oceans: rising temperatures as a result of climate change and the spread of invasive species. This summer, our team assisted master's student June Arriens with data collection for her thesis. Arriens' topic of study includes intertidal predator-prey relationships in the Gulf of Maine and how they are affected by increasing temperatures, invasive species, and predator sex. The species involved in our experiments included Hemigrapsus sanguineus (Asian shore crab), an invader from East Asia first recorded in the United States in the 1980's, and the native snail Littorina obtusata (smooth periwinkle). Our team conducted three different experiments: a determination of prey critical size (the largest snail a crab can crush), prey choice (crabs fed snails of multiple sizes) to determine preferred size, and no-choice (crabs fed all one size snail) to assess feeding rate. . The basic outline of these experiments consisted of collecting Hemigrapsus of both sexes across a size range as well as L. obtusata across a size range, acclimating the crabs and snails to randomly assigned temperature treatments (normal and elevated to reflect changing temperatures), determining the critical size by feeding crabs progressively larger snails until they could not be crushed, determining which size snails the crabs prefer to eat given a choice, then observing how many snails of a specific size a crab can crush within a given time period. Results from these experiments could provide further insight into how invasive predators can alter native prey population structure as well as how climate change will continue to affect this system of study. In addition, few foraging studies have been conducted using female crabs.
In addition to these experiments, we conducted two separate studies to understand crab foraging behavior and crushing strength. In the first study, we set up a controlled filming project to capture preliminary data on foraging habits of H. sanguineus, such as handling method, handling time and rate at which a given quantity of L. obtusata were eaten. Crabs were acclimated in an aquarium with identical conditions (size, substrate) to the filming tank and kept at room temperature (about 19°C) under fluorescent lights with a photoperiod of about 9 hours. After at least 24 hours of acclimation, crabs were taken out one by one for filming periods of 1 hour each
in darkness to maximize foraging activity. Five snails under their critical size (determined from Arriens data) were added to the tanks. Analysis of foraging techniques (e.g., which claw was dominantly used; if the snails were crushed or probed, how quickly they were eaten) will provide information about the efficacy of H. sanguineus as a predator in the Gulf of Maine. This experiment was also unusual in its comparison of female and male crabs to determine differences between sexes. These observations will inform future experimental and field-based projects that monitor the ongoing takeover of H. sanguineus in the rocky intertidal.
In the second study, we tested the absolute crushing force H. sanguineus exerted on snails. The crushing force experiment was conducted by having the crabs pinch a pair of small metal rings connected to a force transducer. The rings were separated to a distance of 30% of the crab's claw gape to mimic force used in the natural environment. By calibrating the transducer with weights from 10g to 200g, we were able to compare the mV of force measured by the transducer with the weights and determine the grams of force the crabs were able to exert. While the crabs were sometimes reluctant to pinch the transducer, this experiment provided a framework for understanding how much force the crabs are capable of exerting, and this research will be refined to create a more consistent format for measuring crab crushing force.

SURF Abstract Submission & Post Program Survey 2020

Name	Ellen Dong
Year of Graduation	2022
SURF Advisor	Jordan Crouser, Computer Science
SURF Field of Study	Computer Science

Title of Abstract/Research Adaptive Filtering

Please type your abstract below.

Within our research group, we focused on the overall question, "How do we provide suggestions?". This question was further broken down to "How to make suggestions", "What is a suggestion", "Are there different types of suggestions?", and understanding how prior work defined or approached those suggestions. Through research of several different articles, we synthesized the different ways different UI's provided suggestions. For example, for Google maps, the researchers chose to reduce the quantity of geographical entities by finding the top ranked k places. Another example of an article that was helpful was in the article, "Declarative Interaction Design for Data Visualization", the researchers introduced a model of declarative interaction design for data visualizations. Within their model, they used signals and production rules in order to maintain their interaction techniques.
The suggestions and different methods were then implemented into the UI, where we tried to improve the user's experience by changing the format of the airbnb room placements and increasing the size of certain buttons in order to draw the attention of the user to their usage. After updating the UI, the website was then tested through several test subjects who had varying degrees of knowledge of technology. After the test subjects tried to work with the UI, they gave several feedback on how to improve the UI and their experience. They also gave feedback on whether the suggestions were helpful in their experience.

SURF Abstract Submission & Post Program Survey 2020

Name	Christine Park
Year of Graduation	2022
SURF Advisor	Maren Buck, Chemistry
SURF Field of Study	Chemistry

Please type your abstract below.

Hydrogels are water-swollen polymeric networks that have versatile applications in the biomedical and engineering fields such as contact lenses, wound dressings, and soft robots. Specifically, hydrogels actuators are stimuli responsive hydrogels that follow the mechanism of gel swelling and contraction in order to perform movement. The previous work done in the Buck Lab has focused on the functionalization of poly(2-vinyl-4,4'-dimethyl azlactone) (PVDMA) based gels with small molecule amines upon UV irradiation. The main goal of this summer was to understand the chemical gradient of the gels that resulted from small molecule diffusion after functionalization through various sets of experiments.

All hydrogel experiments were done with PVDMA-based gels at 25% crosslinking density with Jeffamine-600. The first set of experiments were focused on hydrogel functionalization with the small molecule of photocaged dimethylethylene diamine. Over the course of 0, 2, 5, and 8 minutes, FT-IR spectroscopy displayed an overall decrease in the carbonyl peak and an increase in the cyano and amide functional groups which suggested the functionalization of the bottom surface of the hydrogels over time. The next set of experiments focused on the same functionalization, but with a different amine, photocaged ethylene diamine. Similarly, the FT-IR data for these gels at 0, 2, 5, and 8 minutes suggested that the gels became more functionalized over time. The last set of experiments focused on the diffusion of un-photocaged DMEDA. Unlike the other two data, FT-IR suggests that the bottom surface of the hydrogels were not functionalized over the course of 80 minutes. This particular piece of data indicated that the natural diffusion of small molecules will take relatively long to see full functionalization on the bottom surface of the hydrogels. Future work will focus on the further characterization of hydrogel gradients through scanning electron microscopy (SEM), photopatterning hydrogels for actuation purposes, fabricating CO2 responsive gels, and creating a hydrophobic and hydrophilic hydrogel for oil capturing purposes.

SURF Abstract Submission & Post Program Survey 2020

Name	Lilit Danielyan
Year of Graduation	2022
SURF Advisor	Benita Jackson, Psychology
SURF Field of Study	psychology

Title of Abstract/Research Built and Natural Environments Effects on Psychological Flexibility: Review of Literature and Study Designs

Please type your abstract below.

Recent studies show that even brief time in settings with nature (e.g., a park) increases cognitive function, compared to similar time spent with less nature-based elements (e.g., buildings; Nisbet & Zelenski, 2011). One important predictor of cognitive function that, to our knowledge, has yet to be linked to exposure to nature is psychological flexibility. Arguably a critical key common pathway to mental and physical health (Kashdan & Rottenberg, 2010), psychological flexibility is thus a psychological trait holding promise as a potent point of intervention. For this project, we reviewed literature in support of developing empirical investigations to test if exposure to nature (v. built environments) is associated with greater psychological flexibility. We also seek to test for a unique association between nature exposure and psychological flexibility beyond related but different constructs (e.g., time perspective). Additionally, we identified potential pathways (e.g., awe), amplifiers (e.g. self-compassion), and dampeners (e.g., rumination) for the link between nature exposure and psychological flexibility, should it exist. We designed two sets of empirical examinations: a correlational study to test initial associations, and an experimental study, to test a replication and extension Nisbet and Zelenski's (2011) research on nature exposure and cognition, in our version, focusing on psychological flexibility as the dependent variable. Relevant to our increasingly online world, our extension will further investigate the effects of virtual exposure to natural and built environments on psychological flexibility. If such a link exists, this can lay groundwork for later intervention research testing the 'minimal nature dose' - including amount of time and type (in person v. virtual) - needed to boost psychological flexibility.

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SURF Abstract Submission & Post Program Survey 2020

Name	Linnea Schultz
Year of Graduation	2022
SURF Advisor	David Bickar, Chemistry
SURF Field of Study	Biochemistry

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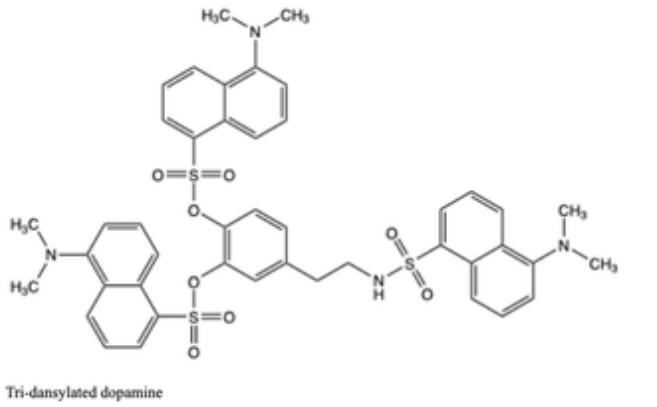

Title of Abstract/Research

Quantifying Dopamine Through Dansylation and Purification Analysis

Please type your abstract below.

Parkinson's disease is a neurodegenerative disorder that causes dopamine (DA) deficiency due to decreased dopaminergic neurons. By developing a procedure to quantify salivary dopamine concentration, the lab aims to explore a potential Parkinson's diagnostic metric. Dansylation is performed to prevent oxidation and increase the size and charge of the molecule, so it can be better quantified through mass spectrometry (MS). During the summer the lab focused on reacting dansyl chloride with DA and its metabolites homovanillic acid (HVA), 3,4-Dihydroxyphenylacetic acid (DOPAC), and 3-Methoxytyramine (3-MT). The fluorescence and absorbance of dansylated dopamine and its derivatives were examined, which confirmed the reaction and purification procedures and provides information for future quantification using MS.

Water and ethanol were both used as solvents for spectroscopy, but ethanol was used for all compounds because of its lesser polarity. This allowed comparison of the wavelengths at which maximum absorbance and fluorescence were achieved across all compounds. The smallest molecule, hydrolyzed dansyl (dansOH), had the lowest λ-maxes: 455 for fluorescence and 300 for visible light. dans-DOPAC and dans-HVA had the highest λ-maxes: 524 for fluorescence and 352 for visible light and 525 for fluorescence and 345 for visible light, respectively. dans-3-MT was intermediate with 510 for fluorescence and 340 for visible light, and dans-DA had the lowest λ-maxes of the dopamine derivatives with 506 for fluorescence and 336 for visible light. These values seem to loosely follow a pattern, with the portion of the molecule made up of dansyl groups correlating with lower λ-maxes. However, some of these values are also so close together that it would be difficult to differentiate between compounds in a mixed sample.

Standard samples were weighed after drying to determine product yield. Comparison between theoretical and practical yield gave overall reaction yield for d-dopamine: 104%, d-HVA: 80%, d-DOPAC: 76%, and d-3-MT: 81%, averaging to 85.25% yield. Prior to drying, standards were characterized through fluorescence and UV-Vis spectroscopy to determine which fractions were most pure, which were then included.

Streamlining and improving the procedure remains important. However, with successful purification and characterization procedures, the project could be expanded into the clinical realm of collecting salivary samples from individuals with and without Parkinson's to determine the relative ranges of salivary dopamine concentration.

SURF Abstract Submission & Post Program Survey 2020

Name	Talia Goldwasser
Year of Graduation	2022
SURF Advisor	Ileana Streinu, Computer Science
SURF Field of Study	Computer Science

Please type your abstract below.

In the study of viruses and their behaviors, rigidity analysis of the viral capsid can lend new insights that may eventually lead to new countermeasures. However, the level of complexity present in even the simplest viruses can make such analyses prohibitively computationally expensive. This summer, I worked to build on the code created by Smith student Sakina Ali in her honors thesis, where she explored forms of modeling of the viral capsid that would decrease its computational complexity, while still preserving the features used in rigidity analyses. I worked on broadening her results to apply to a wider range of viruses, as well as expanding upon them to create new models. Our methods are based on the convex hull, a mathematical construct that encloses a set of points (in this case, atoms) within the smallest possible convex volume.
[Image: A model of the capsid of the cowpea chlorotic mottle virus, displayed using the software Jmol. Each protein chain within the capsid is represented by its convex hull, a polyhedron in its shape and location.]

SURF Abstract Submission & Post Program Survey 2020

Name	Ava Brookshier
Year of Graduation	2023
SURF Advisor	Laura Katz, Biological Sciences
SURF Field of Study	Biological sciences

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Title of Abstract/Research

Bioinformatic assessment of Arcellinida identity and symbionts

Please type your abstract below.

The Arcellinida are a group of testate, or shelled, amoebae within the larger clade of Amoebozoa. This summer, I studied these testate amoebae with the main focus of investigating potential bacterial symbionts of Arcellinida. Studies have found that many members of Amoebozoa harbor bacterial symbionts (Herrera et al. 2020, Schulz et al. 2015, Tsao et al. 2017, and many others), including members of the bacterial phyla Proteobacteria and Chlamydiae (Horn and Wagner 2004). However, little is known about the nature of these relationships, and few articles focus on symbionts of testate amoebae.

Through various bioinformatic processes, I investigated testate amoeba DNA sequenced through whole-genome amplification (WGA), with a particular focus on Hyalosphenia papilio, a testate amoebae that harbors Chlorella symbionts (Gomaa et al. 2014). I wrote a script in Python that automates read mapping of rDNA to a large reference of Amoebozoa and Rhizaria in order to see how well rDNA of H. papilio matches references from a database of sequences called GenBank. My team and I then worked with a program called Spades to assemble reads, then used another program called Barrnap to assess the origin of rDNA found in these assembled reads. I wrote a Python script to pull out the 18s sequences from the files that Barrnap produces, and I am now working on automating BLAST, a tool that takes a nucleotide sequence and finds similar sequences, for these sequences and recording data from the BLAST results. This bioinformatic work has two overall goals: first, to assess the identity of these amoeba sequences, and second, to look for any patterns that may indicate the presence of symbiotic bacteria.

In addition to bioinformatic work, I learned several important lab skills. I learned to use pipettes and microscopes as well as how to make plates using moss and water gathered from bogs. I learned to identify various taxa of Arcellinida and other microbes commonly seen under the microscope. With a group of other students, I participated in a journal club that focused on symbiosis, which I plan to continue with into the fall in order to expand my knowledge of symbiosis. I also learned to do WTA (whole transcriptome analysis) on single cells, and I helped to write protocols for new total RNA kits, which we plan to use in the future to assess the presence of symbionts in testate amoebae and ciliates. As I transition into the fall semester, I plan to continue my bioinformatic work, strengthen my Python skills, and run the total RNA kit on testate amoebae.

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SURF Abstract Submission & Post Program Survey 2020

Name	Jennifer Wise
Year of Graduation	2023
SURF Advisor	Chris Vriezen, Biological Sciences
SURF Field of Study	Biological Sciences

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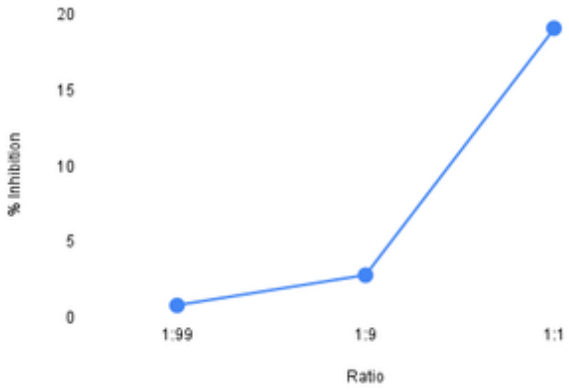

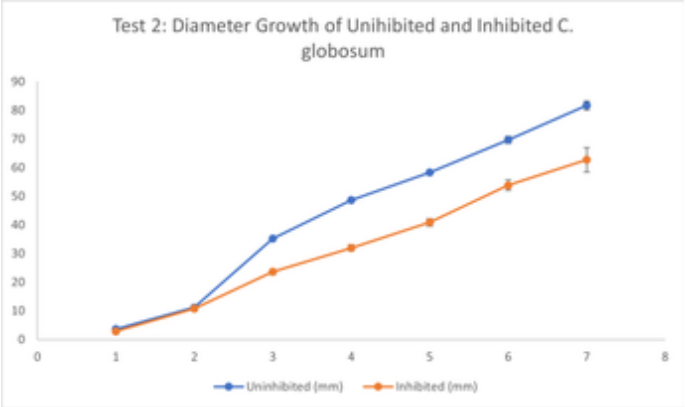

Title of Abstract/Research Biology of Antibiotic Producers

Please type your abstract below.

Research this summer was split into five main experiments which helped to further the goals of the lab. One, liquid cultures of E. coli and CVAP#3 were mixed in 1:1, 9:1, and 99:1 parts respectively. The cultures were scored on plates with Staphylococcus species and E. coli was used as a negative control while CVAP#3 was used as a positive control. Results showed an approximately 10-fold decrease in inhibition as the ratio of CVAP#3 to E. coli decreased.

Using work from the thesis of Aoi Ogawa '20, a simulation of bacterial inhibition of soil isolates studied in the lab was run. At the end of each run, fewer bacteria remained and in unequal amounts. This could be used to study diversity in bacterial communities and identify more competitive isolates.

Continuing past work, 16 isolates were tested for DNase activity. Using DNase activity information, the competitiveness of isolates was examined and showed that DNase-producing isolates were more competitive in the simulation than non-DNase-producing isolates.

DNA isolation was performed on sixteen bacterial soil isolates that had been collected in previous years. Sequencing will be performed after the end of summer. These were chosen for their inhibition of many other bacterial strains as well as DNase production in some isolates. Sequencing of these genomes will allow us to better understand their identities and the secondary metabolites that they may produce.

The inhibition of the fungus C. globosum was tested using soil isolates. This was also done to determine the necessary methods and tools as well as to measure the growth rates of the inhibited and uninhibited colonies. This research will allow for future studies, and potentially a thesis.

SURF Abstract Submission & Post Program Survey 2020

Name	So Hyun Park
Year of Graduation	2023
SURF Advisor	Alexandra Strom, Chemistry
SURF Field of Study	Chemistry

Please type your abstract below.

There are increasing interests in iron, a versatile metal that could possibly replace palladium and other transitional metal catalysts. Since iron is abundant on the Earth, it is more accessible and less expensive than other transition metals such as palladium and iridium. Furthermore, iron is less toxic than other metals because iron has been largely incorporated into our biological systems. For example, hemoglobin uses iron to transport oxygen in our blood vessels. Another advantage of iron is its versatile oxidation state from -2 to +6 which allows iron to participate in various reactions.
During the summer, we have created a C-N bond by utilising iron as a catalyst for cross-dehydrogenative coupling reactions. By cleaving off one C-H bond and one N-H bond we have successfully made alpha-amination of deoxybenzoin with p-toluenesulfonamide and N-benzyl p-toluenesulfonamide. Making a C-N bond is a huge success and is essential for various fields such as medicine and agriculture. As most of our biological molecules and drugs contain C-N bonds, it is essential to develop different ways to make the bond. So far, our best conditions for alpha-amination is 1.0 eq deoxybenzoin, 1.2 eq p-toluenesulfonamide, $FeBr_3$, DDQ, and DCE at 100 C for 24 h. During the summer, we tried varying reaction conditions such as iron sources, temperature, oxidant, reaction time, and additives. Even though we got the C-N bond, the product yield is not consistent. It ranges around 40-50%. Thus it is vital to have consistent product yield with the same conditions before continuing our project.
In the future, we would like to experiment with different substrates of ketones and sulfonamides, and ultimately synthesize amination that is not restricted to ketones nor sulfonamides. In this way, it would be much more beneficial to pharmaceutical and other chemistry areas where C-N bond is essential. Furthermore, we would like to try more conditions to increase the yield.

SURF Abstract Submission & Post Program Survey 2020

Name Samantha Aiyathurai

Year of Graduation 2024

SURF Advisor Jordan Crouser, Computer Science

SURF Field of Study Data Visualizations

Title of Abstract/Research Understanding Data Visualizations

Please type your abstract below.

With the 24-hour news cycle, more vital information is conveyed to the general population using data visualizations than ever before. As a result, it is vital to understand how different people understand

different visualizations and how to teach higher levels of visualization literacy to the general population. This summer, I worked on two projects in the HCV Lab that researched that.

The first project I worked on was the individual differences project. This project researched how someone's individual differences impact their understanding of data visualizations. This summer, we worked to perfect our new interface for running experiments. I created tutorials of the interface and ran pilot tests. After the pilot tests, we compiled the feedback from the pilot testees and made appropriate changes before running more pilot tests.

The second project I worked on was the visualization literacy project. This project was in its infancy. We researched academic papers on visualization and cataloged what aspects of visualization literacy had yet to be explored. We then decided to focus on the education of visualization literacy. We continued researching and understanding studies already made about the education of visualization literacy. We sorted what we found by focusing on which demographics had been studied and what styles of education were used.

SURF Abstract Submission & Post Program Survey 2020

Name	Catherine Spencer
Year of Graduation	2022
SURF Advisor	Rachel Koh, Engineering
SURF Field of Study	Sustainable Materials/Engineering
Please list co-authors of your abstract (if applicable)	Madison Coombs

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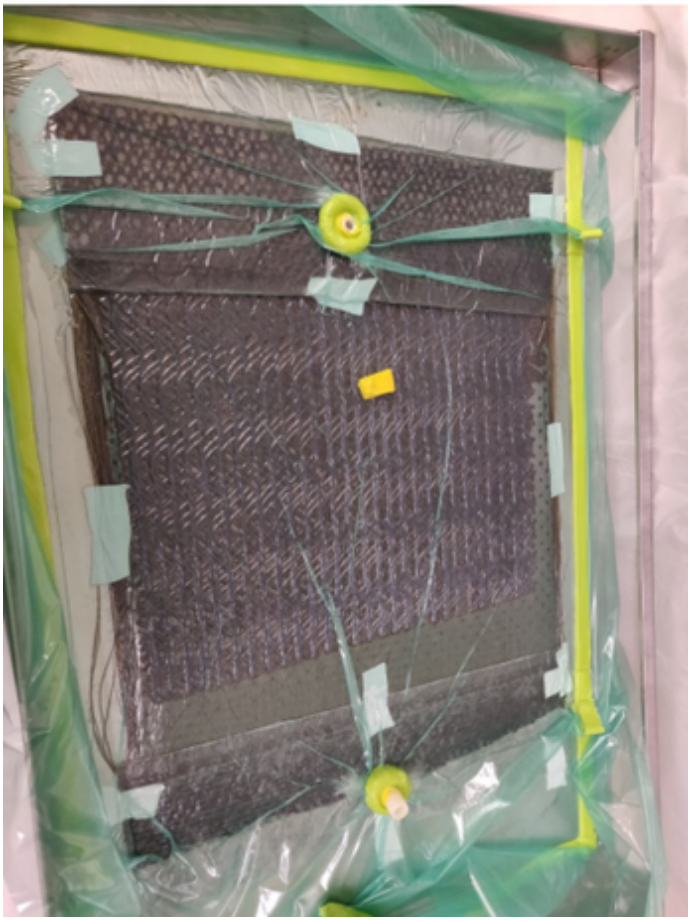

Title of Abstract/Research

Sustainable Materials Flax Composite for Lightweight Applications

Please type your abstract below.

When looking at strong composite materials for applications in which weight is a factor—such as wind turbines, aerospace, and more—most options are carbon fiber or fiberglass. Those materials are incredibly strong and durable, but are not environmentally conscious. The components are energy intensive to manufacture, are made from petrochemicals, and are difficult to recycle. In contrast, natural fiber composites are made from plant material, and have less of an environmental impact at the end of life. This work has focused on manufacturing and testing these natural fiber composites. Specifically, through vacuum infusion, we coat flax fibers with a biobased resin which cures, creating a stiff board. Instead of the carbon in the resin coming entirely from fossil fuels, about 40% comes from biological sources, meaning that it is less harmful to manufacture, and decompose. This summer we have fabricated 16 plates of this material, while adapting the infusion process for more consistent results and testing new infusion methods that use less disposable plastic. Additionally, we tested several composite test coupons in tension to establish and compare their material properties, and prepared new couponsto be tested. The next steps of this research are to continue tension testing for the plates created, then to analyze the data as part of a larger study on specimen sizes. This study aims to quantify the differences in properties between different coupon widths and fiber orientations.

SURF Abstract Submission & Post Program Survey 2020

Name	Anna Peel
Year of Graduation	2022
SURF Advisor	Benita Jackson, Psychology
SURF Field of Study	Psychology
Please list co-authors of your abstract (if applicable)	Benita Jackson, Marta Almazovaite, Egypt Ballet, Lilit Danielyan, Suejona Miah

Title of Abstract/Research Built and Natural Environments Effects on Psychological Flexibility: Review of Literature and Study Designs

Please type your abstract below.

Recent studies show that even brief time in settings with nature (e.g., a park) increases cognitive function, compared to similar time spent with less nature-based elements (e.g., buildings; Nisbet & Zelenski, 2011). One important predictor of cognitive function that, to our knowledge, has yet to be linked to exposure to nature is psychological flexibility. Arguably a critical key common pathway to mental and physical health (Kashdan & Rottenberg, 2010), psychological flexibility is thus a psychological trait holding promise as a potent point of intervention. For this project we reviewed literature in support of developing empirical investigations to test if exposure to nature (v. built environments) is associated with greater psychological flexibility. We also seek to test for a unique association between nature exposure and psychological flexibility beyond related but different constructs (e.g., time perspective). Additionally, we identified potential pathways (e.g., awe), amplifiers (e.g. self-compassion), and dampeners (e.g., rumination) for the link between nature exposure and psychological flexibility, should it exist. We designed two sets of empirical examinations: a correlational study to test initial associations, and an experimental study, to test a replication and extension Nisbet and Zelenski's (2011) research on nature exposure and cognition, in our version, focusing on psychological flexibility as the dependent variable. Relevant to our increasingly online world, our extension will further investigate the effects of virtual exposure to natural and built environments on psychological flexibility. If such a link exists, this can lay groundwork for later intervention research testing the 'minimal nature dose' - including amount of time and type (in person v. virtual) - needed to boost psychological flexibility.

References

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SURF Abstract Submission & Post Program Survey 2020

Name	Sara Halili
Year of Graduation	2022
SURF Advisor	Steve Williams, Biological Sciences
SURF Field of Study	Biology

Title of Abstract/Research

Molecular characterization of an odorant binding protein in Aedes polynesiensis (apobp), vector species for lymphatic filariasis and dengue virus

Please type your abstract below.

Aedes polynesiensis—a highly prevalent mosquito in the South Pacific—constitutes a crucial vector for the transmission of lymphatic filariasis, dengue, zika, chikungunya, and Ross-river virus. To control this species' vector competence, the mosquito's olfaction, instrumented by odorant-binding proteins and odorant-receptor proteins, comprises an important avenue for exploration as it guides the mosquito's host seeking and oviposition. This summer I investigated the role of two residues, tyrosine and arginine, in the binding cavity of a heavily expressed A. polynesiensis odorant-binding protein as it relates to its binding to linoleic acid, a ligand present in human sweat. My main tasks this summer involved making the wildtype and mutant versions of the odorant-binding protein using E. coli as a heterologous expression system. I will continue this task in the fall as part of my honors thesis project. Once I have made the proteins of interest, I will test the proteins' binding affinity to linoleic acid using a fluorescence competitive binding assay.

SURF Abstract Submission & Post Program Survey 2020

Name	Sophie Schneider
Year of Graduation	2023
SURF Advisor	L. David Smith, Biological Sciences
SURF Field of Study	Biology
Please list co-authors of your abstract (if applicable)	Maggie Stoffer, Elena Grandbois

Title of Abstract/Research Foraging Habits of Hemigrapsus sanguineus

Please type your abstract below.

Anthropogenically driven phenomena continue to plague the world's oceans. The Gulf of Maine, spanning from Cape Cod to Nova Scotia, is a system exhibiting two major ways in which humans have impacted oceans: rising temperatures as a result of climate change and the spread of invasive species. This summer, our team assisted master's student June Arriens with data collection for her thesis. Arriens' topic of study includes intertidal predator-prey relationships in the Gulf of Maine and how they are affected by increasing temperatures, invasive species, and predator sex. The species involved in our experiments included Hemigrapsus sanguineus (Asian shore crab), an invader from East Asia first recorded in the United States in the 1980's, and the native snail Littorina obtusata (smooth periwinkle). Our team conducted three different experiments: a determination of prey critical size (the largest snail a crab can crush), prey choice (crabs fed snails of multiple sizes) to determine preferred size, and no-choice (crabs fed all one size snail) to assess feeding rate. . The basic outline of these experiments consisted of collecting Hemigrapsus of both sexes across a size range as well as L. obtusata across a size range, acclimating the crabs and snails to randomly assigned temperature treatments (normal and elevated to reflect changing temperatures), determining the critical size by feeding crabs progressively larger snails until they could not be crushed, determining which size snails the crabs prefer to eat given a choice, then observing how many snails of a specific size a crab can crush within a given time period. Results from these experiments could provide further insight into how invasive predators can alter native prey population structure as well as how climate change will continue to affect this system of study. In addition, few foraging studies have been conducted using female crabs.

In addition to these experiments, we conducted two separate studies to understand crab foraging behavior and crushing strength. In the first study, we set up a controlled filming project to capture preliminary data on foraging habits of H. sanguineus, such as handling method, handling time and rate at which a given quantity of L. obtusata were eaten. Crabs were acclimated in an aquarium with identical conditions (size, substrate) to the filming tank and kept at room temperature (about 19°C) under fluorescent lights with a photoperiod of about 9 hours. After at least 24 hours of acclimation, crabs were taken out one by one for filming periods of 1 hour each
in darkness to maximize foraging activity. Five snails under their critical size (determined from Arriens data) were added to the tanks. Analysis of foraging techniques (e.g., which claw was dominantly used; if the snails were crushed or probed, how quickly they were eaten) will provide information about the efficacy of H. sanguineus as a predator in the Gulf of Maine. This experiment was also unusual in its comparison of female and male crabs to determine differences between sexes. These observations will inform future experimental and field-based projects that monitor the ongoing takeover of H. sanguineus in the rocky intertidal.

In the second study, we tested the absolute crushing force H. sanguineus exerted on snails. The crushing force experiment was conducted by having the crabs pinch a pair of small metal rings connected to a force transducer. The rings were separated to a distance of 30% of the crab's claw gape to mimic force used in the natural environment. By calibrating the transducer with weights from 10g to 200g, we were able to compare the mV of force measured by the transducer with the weights and determine the grams of force the crabs were able to exert. While the crabs were sometimes reluctant to pinch the transducer, this experiment provided a framework for understanding how much force the crabs are capable of exerting, and this research will be refined to create a more consistent format for measuring crab crushing force.

SURF Abstract Submission & Post Program Survey 2020

Name	Rana Gahwagy
Year of Graduation	2022
SURF Advisor	Gregory de Wet, Geosciences
SURF Field of Study	Geosciences
Title of Abstract/Research	Investigating FTIRS Applications in Paleoclimate Research

Please type your abstract below.

In order to understand and contextualize ongoing anthropogenic climate change, we must first understand the climate of the past. This is accomplished using proxies, indirect estimates of past environmental and climate conditions by which we can infer things like temperature and other climate variables. Technological and methodological advances have allowed for a wider range of proxies to be analyzed at higher resolutions, but proxies require further study in order to be applied and employed extensively and reliably. In this project we aim to evaluate the use of a Fourier Transform InfraRed Spectrometer (FTIRS) as a fast and cost-effective proxy for paleoclimatological applications. We are using lake core sediments from eleven different lakes on Baffin Island in the Canadian Arctic.

The location of the lakes is significant because the Arctic is experiencing climate change at a faster rate than lower latitude locations. We found that the lakes' ages span the Holocene, the Last Interglacial, and in some cases, even, the Penultimate Interglacial Period. We aim to see if FTIRS captures changes in organic carbon and biogenic silica (proxies for paleotemperature in Arctic settings) through time. We also hope to compare the data from the FTIRS instrument in UMass to the one in CU-Boulder in order to examine the variability across different labs, especially after having successfully troubleshot the instrument. So far, we observed that the FTIRS can detect the differences in periods and there is disparity between lakes. The remaining question we are left with are why the records between lakes do not always show similar patterns. We further intend to investigate how total organic carbon and biogenic silica are correlated in each lake, and how well this methodology seems to work on Baffin lake sediments.

SURF Abstract Submission & Post Program Survey 2020

Name	Angela Jiang
Year of Graduation	2023
SURF Advisor	Laura Katz, Biological Sciences
SURF Field of Study	Biological Sciences

Title of Abstract/Research Lineage-specific genes in the amoebozoan clade Arcellinida

Please type your abstract below.

Little is known about Arcellinida, a group of testate amoeba (i.e. amoeba with a vase-shaped shell called a test), despite their ecological importance and ubiquity. In particular, their genetics are poorly understood. This summer, the Amoeba team and I started a project concerning Arcellinida-specific genes. Using bioinformatic methods, we set out to determine genes that are only present in Arcellinida and not other amoebozoan clades.

In order to do this, raw data in the form of transcriptomes must first be obtained through a process called whole transcriptome amplification (WTA). Arcellinida cells were picked into test tubes from bog samples obtained from Hawley Bog and Acadia National Park and frozen, capturing the genes expressed at the snapshot where a cell was disintegrated and frozen. After illumina sequencing, the raw data were trimmed and processed through various bioinformatic methods, including using a pipeline known as PhyloToL, which was developed by the Katz lab. This tool ultimately creates many phylogenetic trees of specific gene families (OGs).

We used several other bioinformatic software in the process. First, Barrnap was used to remove rRNAs from the data. Then, CD-Hit was used to cluster very similar genes to reduce computing power and to avoid including unnecessary duplicate genes. Then, we grabbed the ORFs (open reading frames) using a script that Xyrus Maurer-Alcala, a previous Ph.D. student at the Katz lab, wrote. The script checks for genes that exceed a user-defined length, start with the start codons, and end with the stop codon. Moving forward, I want to write a python script that checks for shared genes among the Arcellinida and then use a software called BLAST to see if those shared genes match with any existing genes in the NCBI database.

SURF Abstract Submission & Post Program Survey 2020

Name	Olivia Pomeroy
Year of Graduation	2022
SURF Advisor	Caitlin Shepherd, Psychology
SURF Field of Study	Psychology
Please list co-authors of your abstract (if applicable)	Kira Venables, Andrew Turgeon

Title of Abstract/Research Impulsivity Moderates The Relationship Between ADHD and Bulimia Symptoms in US College Students

Please type your abstract below.

Past studies have demonstrated a relationship between inattentive attention deficit hyperactivity disorder (ADHD) symptoms and bulimia nervosa (BN) symptoms. Impulsivity, most notably attentional and motor, may play a role as previous research demonstrates heightened levels for those with either ADHD or BN symptoms. Few studies have directly examined how different impulsivity factors may impact the connection between these symptoms. Furthermore, the majority of studies have focused on women and/or clinical populations. The current study examined impulsivity as a moderator between ADHD and BN symptoms in a diverse sample of US college students. This population may be at increased risk for disordered eating and ADHD symptomatology; thus, research is needed to identify potential intervention targets. We hypothesized that attentional and motor impulsivity, but not nonplanning, would moderate the relationship between inattentive ADHD and BN symptoms. Finally, we hypothesized that impulsivity would not moderate the relationship between hyperactive/impulsive ADHD and BN symptoms.

The study found that only attentional and motor impulsivity moderated the relationship between inattentive ADHD and BN symptoms. For the attentional impulsivity model, only the interaction term was a significant predictor. For the motor impulsivity model, motor impulsivity and the interaction term were significant predictors. For both attentional and motor impulsivity, the association between inattentive ADHD and BN symptoms was only significant at moderate and high levels. Nonplanning did not emerge as a significant moderator of this relationship, nor did any of the three factors of impulsivity moderate the relationship between hyperactive/impulsive ADHD symptoms and BN symptoms.

Findings of the study indicate that the relationship between inattentive ADHD and BN symptoms is stronger at moderate and high levels of attentional and motor impulsivity. This study contributes to literature suggesting that impulsivity may be a transdiagnostic correlate for ADHD and BN symptoms. Replication of these findings would provide support for using interventions that target attentional and motor impulsivity for college students with inattentive ADHD and BN symptoms. Findings from this SURF project will be submitted as a poster presentation proposal to the American Psychological Association 2022 conference.

SURF Abstract Submission & Post Program Survey 2020

Name	Bridget Duah
Year of Graduation	2024
SURF Advisor	Jamie Macbeth, Computer Science
SURF Field of Study	Computer Science
Please list co-authors of your abstract (if applicable)	Serena Li, Megan McKenzie

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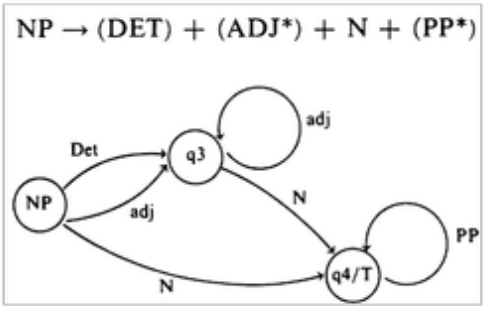

Title of Abstract/Research A Script-Based Story Generator for Product Planning

Please type your abstract below.

Artificial intelligence technology is frequently discussed and popularized in multiple fields these years, and such technology helps people make decisions according to their past experience and generate quick solutions. There is also great potential for artificial intelligence to be used in automobiles, not only in navigating the direction, but also in identifying customer's preferences and making recommendations for selling the cars.

This project was funded by Toyota, with the goal to develop a story generator that creates stories about vehicles in hopes to aid and inspire vehicle design.
The story generator that we are trying to build using Common Lisp automatically writes stories, where the multiple storylines are already decided by the authors. The system is one kind of decision-maker because the generator makes judgements depending on the story's character's thoughts, behavior, and interaction with other characters.

Starting the project, we read papers about the fundamental working structure of story generation and how to create different development of storyline. Then we learned the Common Lisp programming language (from Land of Lisp, video tutorials, and other resources), how to use the Emacs code editor, and the basics of machine learning and language generation also by reading research papers (i.e. Schank, Simmons, and Goldman)

Creating our own story generation, we first decide upon several stories and then try to write multiple scripts corresponding to those storylines for a complete story structure. For example, setting and changing goals/sub goals of the characters as they succeeded or failed from the previous goals to produce several ending options.
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We made minor edits to functions in our language generation files and transferred old comments to their respective updated versions for later use.

SURF Abstract Submission & Post Program Survey 2020

Name	Ibuki Sugiura
Year of Graduation	2022
SURF Advisor	Gregory de Wet, Geosciences
SURF Field of Study	Geosciences
Title of Abstract/Research	Reconstructing past temperature from lake sediments in Tasmania, Australia using the brGDGT biomarker proxy

Please type your abstract below.

Reconstruction of past temperature and other paleoenvironmental conditions has increasingly become important to improve our understanding of the climate system and to prepare for future climate because past conditions, especially intervals warmer than today, are useful analogues for future climate under ongoing global warming. In this project, we reconstructed past temperature from samples collected from a lake sediment core at the Darwin Crater, western Tasmania, Australia using the brGDGT biomarker paleotemperature proxy. The Darwin Crater sediment record is a powerful archive for paleoclimatic reconstructions as it spans approximately the last 800,000 years, consisting of multiple glacial-interglacial cycles. Through this project, we aimed 1) to contribute to the further understanding of regional paleoclimate and paleoenvironment in Tasmania, Australia over long timescales, and 2) to reinforce the scientific community's understanding of the brGDGT (branched glycerol dialkyl glycerol tetraether) biomarker as a relatively new paleotemperature proxy.

With the incredible help from Professor de Wet in the Geosciences Department, we have successfully estimated past temperature from lake sediment samples taken at the depth of 597.9 – 685.3 cm at the Darwin Crater using the brGDGT paleotemperature proxy. This study confirmed that the brGDGT biomarker is applicable for the lake sediment analysis at this study site. Our results also indicate that mean annual air temperature at the Darwin Crater increased as time progressed during the studied period, suggesting that this location has undergone significant environmental changes, possibly related to the shift from a glacial period to an interglacial period. In addition, 18 additional samples collected at the depth of 459 – 596 cm from the same lake sediment core are still in the process of biogeochemical analysis using the same paleotemperature proxy to gain a view of a complete glacial-interglacial cycle and to deepen our understanding of past climate at the Darwin Crater and greater Tasmanian region.

SURF Abstract Submission & Post Program Survey 2020

Name	Megan Holm
Year of Graduation	2022
SURF Advisor	Sarah Witkowski, Exercise and Sports Studies
SURF Field of Study	Exercise and Sports Studies
Title of Abstract/Research	IMAGING FLOW CYTOMETRY (IFC) OPTIMIZATION FOR ENDOTHELIAL MICROVESICLE (EMV) DATA COLLECTION AND ANALYSIS

Please type your abstract below.

INTRODUCTION: Cardiovascular disease (CVD) risk for women increases dramatically during midlife. Since traditional risk factors may not fully explain CVD risk in women, novel tools to identify CVD risk and understand benefits of therapies (i.e. exercise) must be developed. Endothelial microvesicles (EMVs) are fragments derived from endothelial cell membranes (100nm-1µm), and are important markers for understanding endothelial health and CVD risk (Bonetti, 2003; Verma, 2002). However, measurement of EMVs via traditional flow cytometry is complicated due to misidentified individual particles, resulting in false positive and negative results (Armitage, 2019). This problem may be solved by using Imaging Flow Cytometry(IFC).

PURPOSE: The purpose of this project was to develop a protocol to measure EMVs using IFC.

METHODS: Populations of interest included EMVs for endothelial cell activation (CD62e+) and endothelial apoptosis (CD31+/CD42b-). Whole blood was collected into tubes with ACD additive and centrifuged (1,200xg, 15min at 22°C) to obtain blood plasma. Plasma samples were centrifuged (4,500xg, 15min at 20°C) to obtain platelet-poor plasma (PPP). The top two-thirds of the PPP were pipetted into a sterile microcentrifuge tube and centrifuged again (13,100xg, 2min at 20°C) to obtain cell-free plasma (CFP), which was stained with BV421, APC, and PE antibodies. Labeled CFP was diluted using filtered 1XPBS to obtain 1:20-1:1280 dilutions. The CFP dilutions were plated on a 96-well plate (EVs only, single-stained EVs, single-stained EVs plus Triton-X, and filtered PBS and antibody-only controls). EVs were detected with the Amnis IFC (ImageStream mkII), with settings to collect 1-25 million objects between 1 and 5 minutes. The raw image files (.rif) produced by the IFC were analyzed using the Luminex IDEAS 6.2 software. Analysis provided object/mL counts for EMVs in two different size ranges: 100-900nm and <100nm, as well as images of the particles attached to the appropriate antibody.

RESULTS: EMV samples with approximately a 1:300 dilution showed consistent object/mL counts (~4 million) and one-to-one ratios when stained with APC and PE antibodies. BV421 appears to need less dilute EV/EMP samples to return reliable data, this will be explored further.

CONCLUSIONS: These results support using a more-sophisticated IFC technology to image and analyze the EMVs from plasma. Results from this data will lead to the development of a protocol to accurately and reproducibly identify EMVs denoting endothelial apoptosis and activation from plasma samples.

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Bonetti P.O., Lerman L.O., Lerman A. Endothelial dysfunction: a marker of atherosclerotic risk. Arterioscler Thromb Vasc Biol 23: 168 –175, 2003.

Verma S, Anderson TJ. Fundamentals of endothelial function for the clinical cardiologist. Circulation 105: 546 –549, 2002.

SURF Abstract Submission & Post Program Survey 2020

Name	Megan McKenzie
Year of Graduation	2023
SURF Advisor	Jamie Macbeth, Computer Science
SURF Field of Study	Artificial Intelligence (Computer Science)
Please list co-authors of your abstract (if applicable)	Megan McKenzie, Serena Li, Bridget Duah

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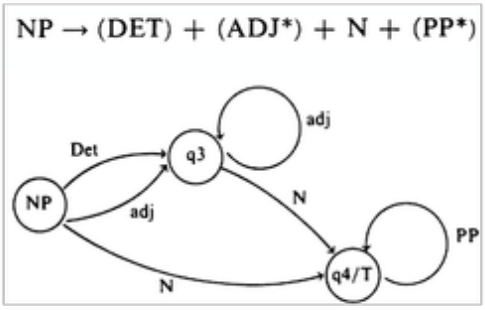

Title of Abstract/Research A Script-Based Story Generator for Product Planning

Please type your abstract below.

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SURF Abstract Submission & Post Program Survey 2020

Name	Leila Yan
Year of Graduation	2023
SURF Advisor	Kate Queeney, Chemistry
Secondary SURF Advisor	Maren Buck
SURF Field of Study	Chemistry
Title of Abstract/Research	Reactive Polymer Film Deposition of PVDMA

Please type your abstract below.

Our goal for this summer research is to use reactive polymer films as an approach to tailoring surface chemistry and creating reproducible surfaces with tunable wettability. For the first part, we focused on the synthesis, functionalization, as well as characterization of PVDMA (2-vinyl-4,4'-dimethyl azlactone). To polymerize PVDMA, two methods with different chain transfer agents, 2-(dodecylthiocarbonothioylthio)-2-methylpropionic acid (DDMAT) and benzyl propyl trithiocarbonate (BPTC), were utilized. 1H NMR was used to calculate percent conversion from monomer to polymer and BPTC was found to have a higher percent conversion over a course of 8 hours. Precipitation proceeded immediately after the completion of polymerization, and it was found that the overall yield of PVDMA polymer is low for both chain transfer agents. During the second part of the research, we deposited smooth thin films using the layer-by-layer approach. To help PVDMA stick to the surfaces, we first attached a layer of PAH (polyallylamine hydrochloride) which sticks to the negatively charged SiO2 surfaces through electrostatic interactions. Thickness and contact angles were measured after depositing each layer.

SURF Abstract Submission & Post Program Survey 2020

Name	Yixiao Li
Year of Graduation	2023
SURF Advisor	Jamie Macbeth, Computer Science
SURF Field of Study	Computer Science
Please list co-authors of your abstract (if applicable)	Megan McKenzie, Bridget Duah

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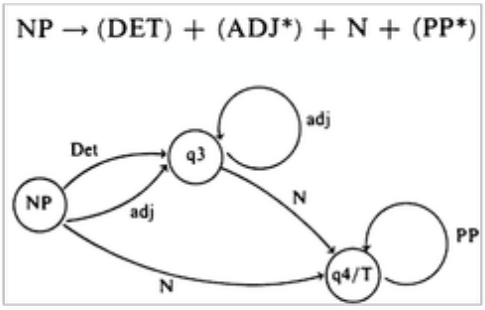

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SURF Abstract Submission & Post Program Survey 2020

Name	Umeyma Ibrahim
Year of Graduation	2022
SURF Advisor	William Williams, Physics
SURF Field of Study	Physics

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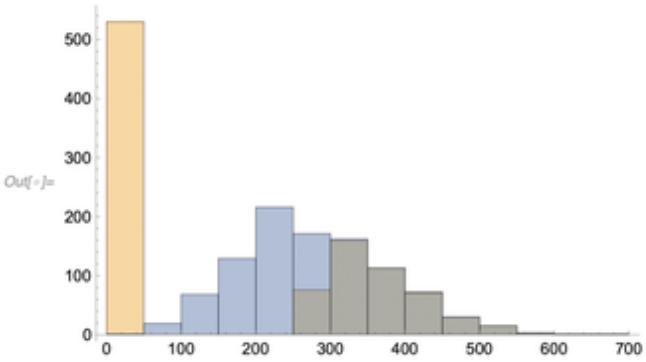

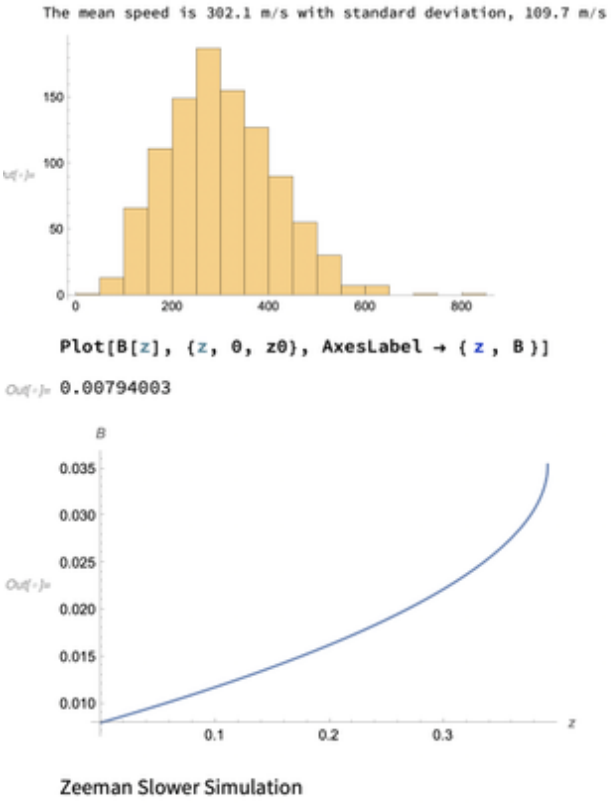

Zeeman Slower Simulation

Title of Abstract/Research Simulations of Mangeto-optical trap for Oxygen atom

Please type your abstract below.

This summer, I explored the feasibility of creating the world's first oxygen magneto-optical trap (MOT) by creating simulations. The technique for creating a MOT is called laser cooling and trapping. Since development in the 1980s to 1990s, MOTs have become the workhorse of atomic physics. Using laser beams with appropriate polarizations and a specifically designed magnetic field, physicists can capture atoms (known as trapping) and slow them down to nearly absolute zero (known as cooling)!

A Zeeman slower takes a beam of atoms, for example beryllium atoms or cesium atoms coming from an oven, and uses a spatially varying magnetic field combined with a laser beam to slow the atoms down. Directly out of the oven, perhaps only 0.01% of the atoms are below the capture velocity. A well-designed Zeeman slower can increase this percentage to above 50%.

Finally, natural oxygen is a molecule. We need to first dissociate the oxygen from its molecular form into its atomic form. Traditionally a discharge source is used to accomplish this task. For this senior thesis, the beginning point of my simulation is after oxygen atoms leave this discharge source. I will create a simulation that follows the atom through a Zeeman slower and into the magneto-optical trap.

To begin, I will assume that we do not need a repumper laser. In other words, we will not include the fact that the oxygen atom needs to be repumped back into the cycling transition every 200 μs. After I have successfully simulated this scenario, I will add in this loss mechanism. The initial goal of this thesis is to answer the question, “Given no repumper, how many atoms on average are in the MOT?”

I started first by figuring out the magnetic field need for the Zeeman slower. Then figuring out the number of coils and turns to create the need magnetic field. The next steps which I will be working on for my senior thesis is different repumping options.

SURF Abstract Submission & Post Program Survey 2020

Name	Lucy Gould
Year of Graduation	2024
SURF Advisor	Michael Barresi, Biological Sciences
SURF Field of Study	Biology
Please list co-authors of your abstract (if applicable)	Georgia Krikorian, Brenda Leyva

Title of Abstract/Research Researching the Role of meteorin in the Developing Zebrafish Nervous System

Please type your abstract below.

In the Barresi Lab, I'm a part of the Disease Modeling Group, which is focused on the gene meteorin. Our research aims to test the hypothesis that meteorin is a key factor in neurogenesis and the differentiation of neural cells. This summer, we are specifically focused on generating a reliable transgenic reporter fish line and mapping expression of the meteorin promoter sequence.

One of the most difficult aspects of zebrafish research is establishing a transgenic fish line. Once this is accomplished, it will open many new avenues of research for our lab. The embryos those fish give can be analyzed for any genetic mutations. We will be able to cross-breed them with other fish which could yield interesting results. Our lab group has a behavioral analysis subgroup that would be interested in investigating these fish as well.

In addition to expanding our population of fish, we have also been working to figure out how the meteroin promoter works. Past students have performed loss of function and gain of function experiments in order to assess any phenotypes that arise from deleting various sites in the promoter region. We have repeated those experiments and have found that the distal sites produce more severe phenotypes including poor circulation, head deformities, and shrunken tails. In order to investigate these fish further, we performed PCR to figure out whether our experiments worked or if any mutations prevented the primers from binding. This led us to repeat the PCR with a new set of primers to double-check for any activity further upstream.

Our plan for the fall semester is to continue our experiments on the meteorin promoter and make sure our fish stay healthy.

SURF Abstract Submission & Post Program Survey 2020

Name	Monalisa Munia
Year of Graduation	2022
SURF Advisor	Kevin Shea, Chemistry
SURF Field of Study	Chemistry

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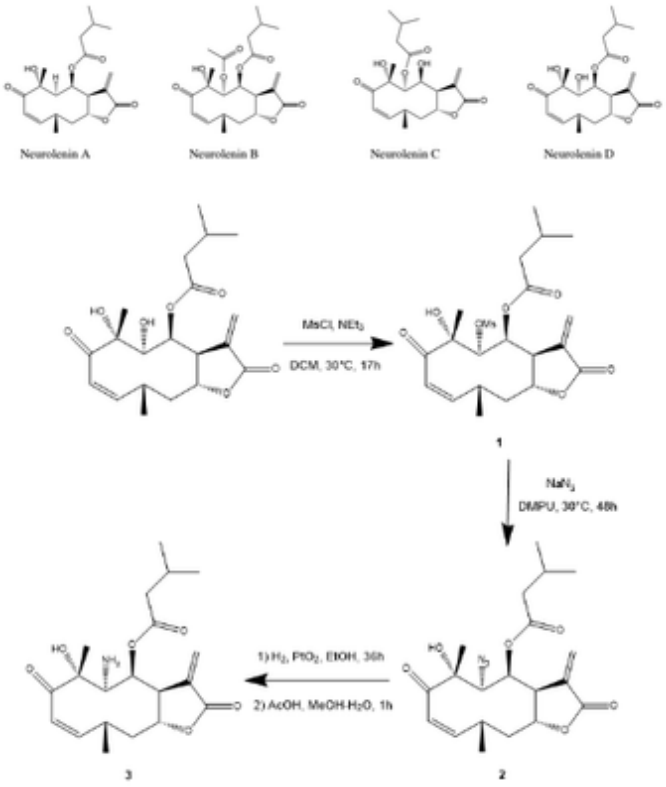


Title of Abstract/Research Synthesis of Nitrogen Containing Neurolenin Derivatives

Please type your abstract below.

Lymphatic filariasis is a neglected tropical disease that currently affects over 120 million people in 72 countries, and is estimated to threaten 893 million people in total. Adult filarial nematodes, that can live upto eight years, produce millions of microfilariae that cause debilitating long term symptoms. Current treatments mainly target the microfilariae, therefore there is still a strong need to develop drugs that target the adult worms, avoiding costly multi-dose, multi-year treatments. Newer drugs that target the nematodes themselves have not been too promising due to lethal side effects, especially in pregnant women and children. As a result, safer antiparasitic compounds need to be explored.

Derived from the leaves of Neurolena lobata, sesquiterpene lactones known as neurolenins (Figure 1) have previously shown promising antiparasitic activity against adult nematodes without inducing acute cell toxicity. Nematode assays of novel neurolenin derivatives allowed us to conclude neurolenin B and acetylated neurolenin C exhibited the most antifilarial activity. Based on the success of esterified analogues, I planned to synthesize a structurally similar analogue during the summer: an amide-neurolenin. A key intermediate of this synthesis is the formation of an aminated neurolenin derivative, which could also be a versatile starting point of a divergent synthesis that can quickly yield multiple new compounds. It would also be the first attempt to introduce a nitrogen heteroatom, as past modifications have only focused on esterification and oxidation reactions of the secondary alcohol. Therefore, the goal of my project is to expand the compound library of neurolenin derivatives by synthesizing nitrogen-containing analogues.

My first attempt to create the amine involved a Mitsunobu reaction between neurolenin D and phthalimide, after which the resulting compound would be transformed into a primary amine via a mechanism reminiscent of a Gabriel synthesis. However, even after various optimizations, this route proved unsuccessful for two reasons: 1) during long reactions under acidic/basic conditions with heat, neurolenin D undergoes transesterification to form neurolenin C 2) the phthalimide is too bulky to be inserted in place of the secondary alcohol before transesterification occurs. Considering the importance of sterics, my second attempt (Scheme 1) involved turning the alcohol into a relatively small leaving group; a mesylate 1.This could be added to sodium azide to create azide 2, which could later be hydrogenated to form amine 3. So far, we have been able to synthesize good yields of relatively pure mesylate, confirmed by 1H-NMR and 13C-NMR spectroscopy. The novel, stable mesylate has been stored to be tested against nematodes.

SURF Abstract Submission & Post Program Survey 2020

Name	Sara Gutierrez
Year of Graduation	2023
SURF Advisor	Michael Barresi, Biological Sciences
Secondary SURF Advisor	Alicia Famiglietti
SURF Field of Study	Biological Sciences
Title of Abstract/Research	Visualization and characterization of the role of bioelectrics

during zebrafish embryogenesis

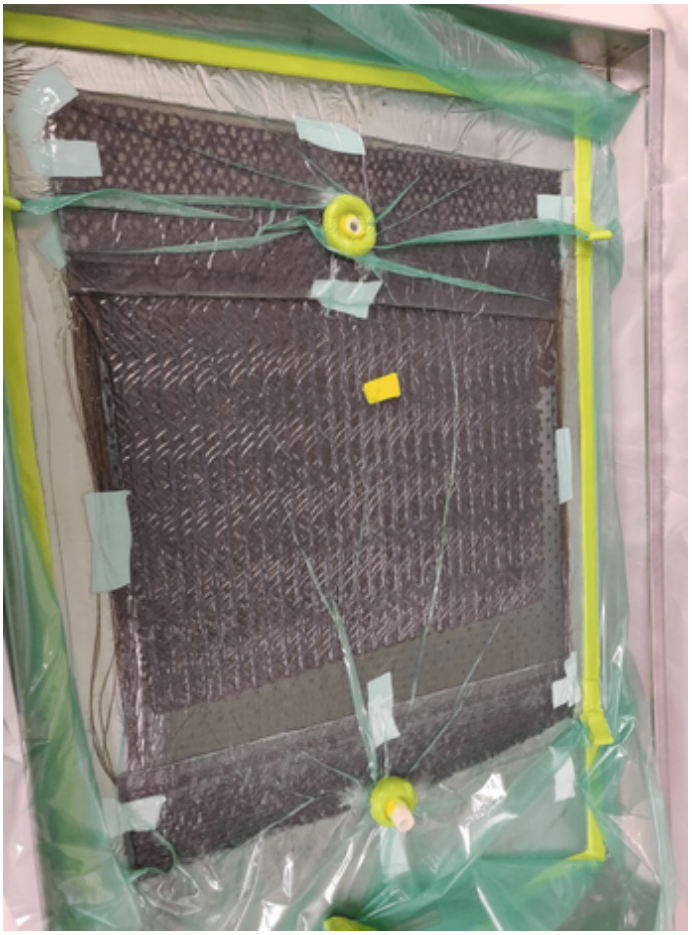
Please type your abstract below.

Bioelectrics is an emerging topic in developmental biology that refers to cells' responses to changes in membrane potentials, such as regulation of gene expression and cell type identity. MicroRNA (miRNA), a short, single-stranded, non-coding type of RNA molecule, is an important factor in the regulation of gene expression, which affects proteins that are translated, and therefore affects the cell type identity. More specifically, one type of miRNA, miR-133, targets Connexin43 (Cx43), a protein that builds gap junction channels, a channel that allows for the direct transfer of ions between cells. A change in this gene regulation would affect the gradients of bioelectric signals which control axis determination and the organism's body plan in general. So, our main goal was to visualize and manipulate these factors and how they affect embryonic development in zebrafish. With two transgenic lines acquired by our lab, Tg(hsp:70: miR-133sp) and Tg(hsp70: miR-133a1), we were able to to utilize heat shocking techniques to upregulate and downregulate miR-133 at a variety of different embryonic stages for different periods of time. Furthermore, since cell differentiation in embryogenesis is known to be induced by families of secreted morphogens such as bone morphogenic proteins (BMP) and fibroblast growth factors (FGF), we also set out to manipulate these connexins and visualized any deviation in FGF expression through in situ hybridization. As a result, we were able to visualize and characterize a consistent phenotype induced by these manipulations in order to relate it back to a disruption in a morphogen pathway in the developing zebrafish embryo. In the future, we hope to look at other morphogen pathways and utilize immunocytochemistry to further understand this disruption during embryonic development.

SURF Abstract Submission & Post Program Survey 2020

Name	Madison Coombs
Year of Graduation	2022
SURF Advisor	Rachel Koh, Engineering
SURF Field of Study	Engineering (sustainable materials)
Please list co-authors of your abstract (if applicable)	Max Spencer

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



Title of Abstract/Research

Sustainable Materials Flax Composite for Lightweight Applications

Please type your abstract below.

When looking at strong composite materials for applications in which weight is a factor—such as wind turbines, aerospace, and more—most options are carbon fiber or fiberglass. Those materials are incredibly strong and durable, but are not environmentally conscious. The components are energy intensive to manufacture, are made from petrochemicals, and are difficult to recycle. In contrast, natural fiber composites are made from plant material, and have less of an environmental impact at the end of life. This work has focused on manufacturing and testing these natural fiber composites. Specifically, through vacuum infusion, we coat flax fibers with a biobased resin which cures, creating a stiff board. Instead of the carbon in the resin coming entirely from fossil fuels, about 40% comes from biological sources, meaning that it is less harmful to manufacture, and decompose. This summer we have fabricated 16 plates of this material, while adapting the infusion process for more consistent results and testing new infusion methods that use less disposable plastic. Additionally, we tested several composite test coupons in tension to establish and compare their material properties, and prepared new couponsto be tested. The next steps of this research are to continue tension testing for the plates created, then to analyze the data as part of a larger study on specimen sizes. This study aims to quantify the differences in properties between different coupon widths and fiber orientations.

SURF Abstract Submission & Post Program Survey 2020

Name	Selma Benmoussa
Year of Graduation	2023
SURF Advisor	Marsha Pruett, Psychology Coparenting
SURF Field of Study	and romantic relationships
Title of Abstract/Research	Co-parenting tool + trust and respect in romantic relationships

Please type your abstract below.

This year's SURF experience was the fruit of a collaboration between Pr. Marsha Pruett (Smith College), Pr. Jonathan Alschech (University of Northern British Columbia) and Pr. Saini (University of Toronto). The first project consisted of translating and distributing the CoPAFS, a tool for co-parenting. Co-parenting is the sharing of parenting responsibilities between two or more adults. The co-parenting tool is aimed at diverse populations in terms of gender, ethnicity, sexual orientation, family types, and dynamics. The purpose of the project is to democratize the tool through language and disseminate it. Future implications include enabling small NGOs, schools, and other organizations to use the results to obtain funding, as well as inform related areas such as law and social work.
For the second part of the project, I helped draft a scoping review featuring 34 articles on "Trust and Respect in Romantic Relationships". Trust is the confidence that the other will be consistently reliable in responding to one's needs and interests (Rempel et al., 1985), while respect means deserved positive self-regard on the basis of one's humanity (Rawls, 1971; Miller, 2001). In parenting, it means regarding the other parent's opinion and values with the same seriousness and regard as one's own. Trust and respect are associated with positive outcomes in romantic relationships. High levels of respect are correlated with loving and liking attitudes, sexual intimacy, and relationship satisfaction (Hendrick & Hendrick, 2006; Frei & Shaver 2002). However, respect in close relationships is an understudied area in psychological research for the obvious role it plays (Hendrick et al., 2011). Trust towards one's partner, in turn, is associated with feelings of closeness, partnership satisfaction, and positive evaluation of the partner (Kleinert & Tobias, 2020). The lack of trust in one's partner often means more emotional instability, conflict, and jealousy, (Kemer et al., 2016; Arikewuyo et al., 2020). In separated and divorced couples, the lack of respect is a problematic dynamic that leads to custody battles in the courts, poor coparenting, and high conflict which is associated with mental health problems for all family members. Unmarried partners who have children together lack basic trust, the bedrock from which respect is developed. Focusing on these two of five factors that emerged as essential in the COPAFS tool will help scholars begin to focus professionals' efforts on how to intervene with parents early and effectively in the decoupling process. Ongoing efforts of the research team (including article writing) will be supported by this literature reveiw.

SURF Abstract Submission & Post Program Survey 2020

Name	McKenzie Swart
Year of Graduation	2022
SURF Advisor	Jesse Bellemare, Biological Sciences
Secondary SURF Advisor	John Berryhill
SURF Field of Study	Biology

Title of Abstract/Research

Conservation Development for Magnolia

Please type your abstract below.

The primary focus of this SURF project was an investigation into the distribution of ex- and in-situ representatives of the species Magnolia fraseri in order to complete a comprehensive survey of their GPS locations, provenance, and any relevant abiotic conditions where they grow. Botanic gardens who reported having a specimen of M.fraseri to BGCI were surveyed with a set of questions. This data was assembled into a comprehensive spreadsheet which catalogues all surveyed botanic gardens' responses. In addition to this, supportive work was done to further the goals of the new Collections Management Plan put forth by John Berryhill by developing a new founder plot site at MacLeish Field Station. The area, formerly choked by invasive species and neglected over the course of fifty years, is now nearly ready for research of M. fraseri to be implemented. This site will become the first location to act as a founder plot for Smith College, which will support a genetic repository of not only M. fraseri but other native understory plants as well. In addition to these tasks I have also become a certified Rare Plant Surveyor for Native Plant Trust, responsible for seeking certain species in locations where they are believed to be present or in decline. This work with NPT has been a complimentary component of working with M. fraseri as it has encouraged broader thinking around native and invasive species as well as connecting our work to other research happening in the field of plant conservation. This SURF project has also paved the way for a new, distinct position for a plant conservation intern for other Smith students to eventually take on. In the future this new role will be a major aspect of the connection between institutions like Native Plant Trust and Smith College as we strive for greater achievements in the field of conservation.

SURF Abstract Submission & Post Program Survey 2020

Name	Egypt Ballet
Year of Graduation	2023
SURF Advisor	Benita Jackson, Psychology
SURF Field of Study	Psychology
Please list co-authors of your abstract (if applicable)	Marta Almazovaite, Lilit Danielyan, Suejona Miah, & Anna Peel

Title of Abstract/Research Built and Natural Environments Effects on Psychological Flexibility: Review of Literature and Study Designs

Please type your abstract below.

Recent studies show that even brief time in settings with nature (e.g., a park) increases cognitive function, compared to similar time spent with less nature-based elements (e.g., buildings; Nisbet & Zelenski, 2011). One important predictor of cognitive function that, to our knowledge, has yet to be linked to exposure to nature is psychological flexibility. Arguably a critical key common pathway to mental and physical health (Kashdan & Rottenberg, 2010), psychological flexibility is thus a psychological trait holding promise as a potent point of intervention. For this project we reviewed literature in support of developing empirical investigations to test if exposure to nature (v. built environments) is associated with greater psychological flexibility. We also seek to test for a unique association between nature exposure and psychological flexibility beyond related but different constructs (e.g., time perspective). Additionally, we identified potential pathways (e.g., awe), amplifiers (e.g. self-compassion), and dampeners (e.g., rumination) for the link between nature exposure and psychological flexibility, should it exist. We designed two sets of empirical examinations: a correlational study to test initial associations, and an experimental study, to test a replication and extension Nisbet and Zelenski's (2011) research on nature exposure and cognition, in our version, focusing on psychological flexibility as the dependent variable. Relevant to our increasingly online world, our extension will further investigate the effects of virtual exposure to natural and built environments on psychological flexibility. If such a link exists, this can lay groundwork for later intervention research testing the 'minimal nature dose' - including amount of time and type (in person v. virtual) - needed to boost psychological flexibility.

SURF Abstract Submission & Post Program Survey 2020

Name	Leyla Akin
Year of Graduation	2023
SURF Advisor	Benita Jackson, Psychology
SURF Field of Study	Psychology
Please list co-authors of your abstract (if applicable)	Benita Jackson, Marta Almazovaite, Egypt Ballet, Lilit Danielyan, Suejona Miah, and Anna Peel

Title of Abstract/Research Built and Natural Environments Effects on Psychological Flexibility: Review of Literature and Study Designs

Please type your abstract below.

Recent studies show that even brief time in settings with nature (e.g., a park) increases cognitive function, compared to similar time spent with less nature-based elements (e.g., buildings; Nisbet & Zelenski, 2011). One important predictor of cognitive function that, to our knowledge, has yet to be linked to exposure to nature is psychological flexibility. Arguably a critical key common pathway to mental and physical health (Kashdan & Rottenberg, 2010), psychological flexibility is thus a psychological trait holding promise as a potent point of intervention. For this project we reviewed literature in support of developing empirical investigations to test if exposure to nature (v. built environments) is associated with greater psychological flexibility. We also seek to test for a unique association between nature exposure and psychological flexibility beyond related but different constructs (e.g., time perspective). Additionally, we identified potential pathways (e.g., awe), amplifiers (e.g. self-compassion), and dampeners (e.g., rumination) for the link between nature exposure and psychological flexibility, should it exist. We designed two sets of empirical examinations: a correlational study to test initial associations, and an experimental study, to test a replication and extension of Nisbet and Zelenski's (2011) research on nature exposure and cognition, in our version, focusing on psychological flexibility as the dependent variable. Relevant to our increasingly online world, our extension will further investigate the effects of virtual exposure to natural and built environments on psychological flexibility. If such a link exists, this can lay groundwork for later intervention research testing the 'minimal nature dose' - including amount of time and type (in person v. virtual) - needed to boost psychological flexibility.

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SURF Abstract Submission & Post Program Survey 2020

Name	Kira Venables
Year of Graduation	2022
SURF Advisor	Caitlin Shepherd, Psychology
SURF Field of Study	Psychology
Please list co-authors of your abstract (if applicable)	Olivia Pomeroy, Andrew Turgeon

Title of Abstract/Research Impulsivity Moderates The Relationship Between ADHD and Bulimia Symptoms in US College Students

Please type your abstract below.

Past studies have demonstrated a relationship between inattentive attention deficit hyperactivity disorder (ADHD) symptoms and bulimia nervosa (BN) symptoms. Impulsivity, most notably attentional and motor, may play a role as previous research demonstrates heightened levels for those with either ADHD or BN symptoms. Few studies have directly examined how different impulsivity factors may impact the connection between these symptoms. Furthermore, the majority of studies have focused on women and/or clinical populations. The current study examined impulsivity as a moderator between ADHD and BN symptoms in a diverse sample of US college students. This population may be at increased risk for disordered eating and ADHD symptomatology; thus, research is needed to identify potential intervention targets. We hypothesized that attentional and motor impulsivity, but not nonplanning, would moderate the relationship between inattentive ADHD and BN symptoms. Finally, we hypothesized that impulsivity would not moderate the relationship between hyperactive/impulsive ADHD and BN symptoms.

The study found that only attentional and motor impulsivity moderated the relationship between inattentive ADHD and BN symptoms. For the attentional impulsivity model, only the interaction term was a significant predictor. For the motor impulsivity model, motor impulsivity and the interaction term were significant predictors. For both attentional and motor impulsivity, the association between inattentive ADHD and BN symptoms was only significant at moderate and high levels. Nonplanning did not emerge as a significant moderator of this relationship, nor did any of the three factors of impulsivity moderate the relationship between hyperactive/impulsive ADHD symptoms and BN symptoms.

Findings of the study indicate that the relationship between inattentive ADHD and BN symptoms is stronger at moderate and high levels of attentional and motor impulsivity. This study contributes to literature suggesting that impulsivity may be a transdiagnostic correlate for ADHD and BN symptoms. Replication of these findings would provide support for using interventions that target attentional and motor impulsivity for college students with inattentive ADHD and BN symptoms. Findings from this SURF project will be submitted as a poster presentation proposal to the American Psychological Association 2022 conference.

SURF Abstract Submission & Post Program Survey 2020

Name	Piper MacDonald
Year of Graduation	2023
SURF Advisor	Niveen Ismail, Engineering
SURF Field of Study	Environmental Engineering
Please list co-authors of your abstract (if applicable)	Emma Lesser, Maddie Davis, Noor Sheikh

Title of Abstract/Research Fate and Impacts of Silver Nanoparticles and Microplastics on Daphnia magna in Treatment Wetlands

Please type your abstract below.

Treatment wetlands for water purification are typically designed to allow for various physical and biological processes that reduce levels of organic contaminants, metals, bacteria, and suspended solids. Grazing by filter-feeding zooplankton such as Daphnia magna can significantly remove pollutants in treatment wetlands. Silver nanoparticles (AgNP) are widely used due to their antimicrobial properties. Plastics are also widely present in the environment and are broken down over time into microplastics (MP) and nanoplastics. The interaction between microplastics, AgNP, and filter-feeding zooplankton are unknown. Silver is toxic to aquatic organisms and understanding the impacts of this contaminant in conjunction with microplastics on zooplankton that are critical to treatment wetland function is necessary.

Our overarching research objective is to characterize aqueous uptake of isotopically labeled 109AgNP (8 nm, citrate-coated) and polystyrene microplastics (PSMP) (monodisperse, 0.5 μm) in D. magna at environmentally relevant concentrations (i.e. 0.02 - 2.5 μg L-1 AgNP; 100 μg L-1 PSMP). We developed effective methods for digesting and running samples with PSMP, daphnia, and 109AgNP on an inductively coupled plasma mass spectrometer (ICP-MS). Preliminary results seem to indicate that influx rates were similar between daphnia exposed to AgNP and AgNP as well as PSMP. Future work will involve characterizing efflux, dietary uptake, and uptake in different water types of 109AgNP and PSMP. We will also use a transmission electron microscope to determine the location of ingested 109AgNP within daphnids.

SURF Abstract Submission & Post Program Survey 2020

Name	Katelyn Pickunka
Year of Graduation	2022
SURF Advisor	Stephanie Jones, Exercise and Sports Studies
SURF Field of Study	Exercise Sports Science (specifically somatosensation in multiple sclerosis populations)
Title of Abstract/Research	Multiple Sclerosis Review of Impaired Somatosensation and Proprioception

Please type your abstract below.

In the Jone's lab, I researched impaired somatosensation in healthy individuals and individuals diagnosed with Multiple Sclerosis (MS). MS is a progressive and incurable neurological disease, where the immune system attacks the myelin sheath on neurons. The myelin sheath's primary function is to protect and isolate the axons of the neurons. People diagnosed with MS experience a multitude of symptoms including declined proprioception. Impaired proprioception is a decline in the ability to sense the relative position of limbs and joints. Furthermore, impaired proprioception can lead to balance issues, increased probability of falls, and uncoordinated movements. Therefore, proprioception assessment is for diagnosing MS and determining the progression of the neurological disease and potential treatments.

There is evidence of somatosensation, specifically mechanoreception, impairment among people with MS; the majority of somatosensation testing is conducted in the clinical field, often using limited, straightforward equipment. Somatosensation is information from various senses being relied on from the peripheral to the central nervous system. Somatosensation includes but is not limited to proprioception and mechanoreception. Mechanoreception is communicated through multiple touch receptors located in the different types of skin. Somatosensation deficits can occur in the stages of relating information from the cutaneous receptors (mechanoreception) or muscle spindles (proprioception) to the later stages of cortical processing. Assessment of somatosensation deficits gives insight into the neurological health of an individual. For MS patients, somatosensory assessment can help diagnose and discover the location of cortical lesions (Klingner & Witte, 2018). In undiagnosed individuals, assessment of somatosensation can help with the diagnosis of MS, and other neurological disorders (Hammer et al., 2013), ("The Diagnosis of Multiple Sclerosis," 2006).

Over the summer I conducted an in-depth review of the literature on the topic of somatosensory deficits in individuals with MS, including impairments of proprioception and cutaneous sensation, as well as clinical and research methodologies to assess somatosensation. Using the information from this review, I created a draft of a review paper targeted to the clinical and research communities on the current state of knowledge of somatosensory impairment in people with MS. Included in this paper are several diagrams that I created to detail sensory and motor pathways in the nervous system and a chart detailing methods of somatosensory assessment. The paper highlights a gap in the clinical and research assessments to bring awareness to diagnostic tools for patients with neurological disorders and to illustrate the importance of assessing somatosensation in those with MS.

SURF Abstract Submission & Post Program Survey 2020

Name	Sasha Zeidenberg
Year of Graduation	2022
SURF Advisor	Jesse Bellemare, Biological Sciences
SURF Field of Study	Plant Biology
Title of Abstract/Research	The Role of Red Coloration in Insect Attraction to Sarracenia Pitcher Plants

Please type your abstract below.

Our project investigated the role of red coloration in insect attraction to carnivorous plants. We set up experiments at MacLeish Field Station using Sarracenia pitcher plants and time lapse cameras to record the insect interactions with our experimental plants, with the goal of seeing whether there is a significant difference in the amount of insects attracted to the plant when there is more red coloration. Since Sarracenia grows with a wide range of natural coloration patterns from solid green to a deep red neck, we were able to create a gradient from no red to full red coloring at each iteration of the experiment setup. After letting the plants sit in the field for multiple hours, we analyzed the video recordings to collect data on how many insects of what types were visiting which color of plant. We also developed a procedure for analyzing the percent red coloration of the plants using FIJI, and began to think about possible ways to map the complexity of red venation on the plants as well as how to test the plants' nectar for sugar content. As we worked on this project over a relatively short timeline, we have not reached any decisive conclusions on the effect of red coloration on prey attraction and capture and will continue the work in Professor Bellemare's lab in the fall semester.

SURF Abstract Submission & Post Program Survey 2020

Name	Victoria Devlin McLoughlin
Year of Graduation	2021
SURF Advisor	Sarah Mazza, Geosciences
SURF Field of Study	Geosciences
Title of Abstract/Research	Tungsten Partitioning in the SE Greenland Archean Thrym Complex

Please type your abstract below.

Earth's tectonic system is scientifically important due to its unique appearance in the solar system, and its role in the planet's geologic, atmospheric, and hydrological cycles. Despite its noted importance, the precise evolution of modern tectonics on this planet has not yet been constrained. The geologic Archean Eon is where geologists focus their attention in attempts to address this question. That is why samples from the Archean Thrym Complex of SE Greenland (a magmatic arc root) were chosen for study in an honors thesis of the same project name by advisor Dr. Sarah Mazza and Victoria Devlin McLoughlin. These rock samples are continuously being geochemically studied, with a particular interest in their tungsten composition as stable tungsten isotopes have been shown to fractionate differently in modern subduction zones depending upon the state of slab dehydration (therefore providing a potential indicator of modern tectonics). The honors thesis and SURF project's focus were to determine if elemental tungsten had been disturbed in post-petrogenic processes. This is because any re-mobilization will cause stable tungsten isotope signatures to provide an inaccurate representation of the state of tectonics at the time of rock formation, which is the end-goal of studying these samples.

During SURF we addressed this goal by first adding onto the data catalog from the Devlin McLoughlin-Mazza thesis by analyzing more samples. To do so new petrographic transect maps were made from the samples de-marking areas of interest for in-situ analysis after study under petrographic microscope. Using the maps, the samples were then analyzed with the SEM at William's College, and later the LA-ICP-MS at Smith College. These procedures resulted in the collection of in-situ major and minor element data for these samples. The second mission of this SURF project was developing trace element method improvements concluded to be necessary to investigate at the end of the honors thesis. We did so by re-collecting data on samples analyzed in the honors thesis and processing them with different LA-ICP-MS collection and data processing techniques to confirm if the trace element signatures seen in the honors thesis were a product of the methods used, or were truly inherent to the rock.

SURF Abstract Submission & Post Program Survey 2020

Name	Katerina Rencs
Year of Graduation	2023
SURF Advisor	Judith Cardell, Engineering
SURF Field of Study	Engineering
Title of Abstract/Research	Transactive Energy and Integration of Renewable Energy Sources

Please type your abstract below.

The power grid of the United States is a system that must remain stable at all times, meaning the energy generated must always equal the demand of its consumers. With the system in place now, the traditional mode of operation is based more on instant commands and responses, creating a pattern of demand that has been, historically, easiest to meet with environmentally-unfriendly methods of energy production, such as coal, gas, or oil. With the advent of renewable energy resources, such as photovoltaic or wind power, maintaining the stability and flexibility of the power grid is a problem that must be addressed to meet the goal of self-sustainability. Despite the sun and wind being renewable, they are stochastic and therefore difficult to integrate into a power grid that must remain predictable. This summer, I reviewed the evolving concept of transactive energy, as it is a facet of the transition to a greener grid.

As transactive energy is a market term that refers to consumers reacting in real time to demand and price fluctuations in electricity, I researched how the role of the consumer is shifting as distributed energy resources (DERs) are integrated into the power grid. Due to my mostly remote circumstances this summer, my research into transactive energy was conducted by reading other published papers and online sources. DERs include technologies and innovations that the consumer can interact with more directly, such as rooftop solar panels, electric vehicles, and smart thermostats. Demand response—how customers can change their normal consumption patterns based on fluctuations in electricity prices— is another example [1]. Looking at the patterns of renewable integrations into several different sections of the U.S., many have invested in demand response programs and projects that allow market participants to shift their role away from that of just the traditional consumer [2]. This evolution includes value signalling, informing customers of price incentives that will both lower the individual's energy costs while reducing peak loads on the grid [3].

In addition, to approach computer modeling of power flows, I began researching Pandapower, a program that utilizes Pandas, a Python data analysis library. The large majority of my experience this summer was with simple three- or four-bus systems and optimal power flows. To continue my research into the fall, I intend to run power flow simulations that involve cost analysis and hopefully refine my understanding of how demand response interacts with the flow of the power grid with future in-person collaboration.

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SURF Abstract Submission & Post Program Survey 2020

Name	Ahlenne Abreu
Year of Graduation	2022
SURF Advisor	Stylianos Scordilis, Biological Sciences
SURF Field of Study	Biochemistry
Title of Abstract/Research	The Effect of a Selective Estrogen Receptor Modulator on the Developing C2C12 Proteome

Please type your abstract below.

Tamoxifen, a popular estrogen-positive breast cancer treatment, functions as a selective estrogen receptor modulator. In this role, tamoxifen competitively binds to estrogen receptors found in breast tissue and blocks the binding of endogenous estrogen which stimulates cancer growth. Estrogen receptors are not confined to breast tissue though, they are also found on muscle cells. Skeletal muscle, like all other tissues in the body, is affected by sex hormones. Also, muscle development, myogenesis, does not only occur during embryonic development, it also occurs when there is muscle damage. Intense muscular exertion is able to create plasmalemmal micro-tears thereby damaging the cells and requiring a recapitulation of myogenesis and tamoxifen could affect these processes, so this must be examined.

To do this, C2C12 cells were grown (n=5, 25 cm2 flasks) in three different media: Dulbecco's modified Eagle's medium (DMEM, control), 0.1 mM Ethanol (EtOH, vehicle control), and EtOH and tamoxifen (80 ng/mL); since tamoxifen dissolves well in EtOH (solubility: 20 mg/mL). The vehicle control is a condition for cells grown only in EtOH to ensure that the changes observed were due to the tamoxifen treatment and not the solvent. I probed the three stages of myogenesis-- myoblast, early myotube, and late myotube-- by extracting the cells at different time points in their development to assay if tamoxifen affected these processes. After the cells reached 80% confluency, I extracted cells from two flasks and then performed a step-down procedure on the other 4 flasks by changing the media to 5% horse serum/DMEM from 10% fetal bovine serum/DMEM which encouraged adjacent cells to fuse and form myotubes; the flasks were fed every 2-3 days. After 5 days, I extracted from another two flasks to mark the early myotubes stage in development. Finally, I extracted from the last two flasks after 9 days once late myotubes formed. After samples were extracted, various proteomics techniques were employed like Lowry Assay, SDS-PAGE, and immunoblot to determine the proteomic changes that occurred in response to growing in tamoxifen. Results of an initial tamoxifen (TAM) dose-response curve (100 uM, 10 uM, 1 uM, 0.1 uM) suggested tamoxifen decreased protein concentration by hindering proliferation; also, 100 uM TAM is cytotoxic. Furthermore, this work is still in progress as I am pursuing this study for my Honors thesis project, so stay tuned for new results.

SURF Abstract Submission & Post Program Survey 2020

Name	Fatima Sheikh
Year of Graduation	2022
SURF Advisor	Niveen Ismail, Engineering
SURF Field of Study	Engineering Science
Please list co-authors of your abstract (if applicable)	Emma Lesser, Maddie Davis, Piper Macdonald

Title of Abstract/Research Fate and Impacts of Silver Nanoparticles and Microplastics on Daphnia magna in Treatment Wetlands

Please type your abstract below.

Treatment wetlands for water purification are typically designed to allow for various physical and biological processes that reduce levels of organic contaminants, metals, bacteria, and suspended solids. Grazing by filter-feeding zooplankton such as Daphnia magna can significantly remove pollutants in treatment wetlands. Silver nanoparticles (AgNP) are widely used due to their antimicrobial properties. Plastics are also widely present in the environment and are broken down over time into microplastics (MP) and nanoplastics. The interactions between microplastics, AgNP, and filter-feeding zooplankton are unknown. Silver is toxic to aquatic organisms and understanding the impacts of this contaminant in conjunction with microplastics on zooplankton that are critical to treatment wetland function is necessary.

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SURF Abstract Submission & Post Program Survey 2020

Name	Laura Campuzano
Year of Graduation	2022
SURF Advisor	Erica Tibbetts, Exercise and Sports Studies
SURF Field of Study	Athletic Identity, Gender, and Race

Title of Abstract/Research The impact of environment on athletic identity, race, and gender - A pilot study

Please type your abstract below.

Almost all work on athletic identity, race, and gender has been done independently of the environments where athletes exist. Yet, identities do not exist in a vacuum, nor are they isolated from one another. Some exceptions to this lack of research include work done by Mignano, Brewer, Winter, and Van Raalte (2006) when they examined how athletic identity differed for female athletes at women's and co-educational colleges. They found that women's college athletes reported higher athletic identity than female athletes at coeducational colleges. The authors suggested that some of the higher scores may result from a higher level of funding for athletics at women's colleges and the freedom for women to embrace more 'masculine' traits in an all-female institution. Also, Dodson-Sims (2005) and Carter (2008) found that black athletes, both male and female, felt more isolated in predominantly white colleges than historically black colleges. The goal of the current study is to identify how different environments impact the differing identities of athletes to establish a baseline for institutions, organizations, and coaches to better support their athletes. As a pilot study, surveys were distributed to recently graduated Division III women's college athletes, with the intent to understand the salience of different identities in different situations (academic, social, and athletic). The survey remains open, seeking more responses to ensure the validity of the study.

SURF Abstract Submission & Post Program Survey 2020

Name	Madeline Davis
Year of Graduation	2022
SURF Advisor	Niveen Ismail, Engineering
SURF Field of Study	Engineering
Please list co-authors of your abstract (if applicable)	Emma Lesser, Noor Sheikh, Piper MacDonald

Title of Abstract/Research Fate and Impacts of Silver Nanoparticles and Microplastics on Daphnia magna in Treatment Wetlands

Please type your abstract below.

Treatment wetlands for water purification are typically designed to allow for various physical and biological processes that reduce levels of organic contaminants, metals, bacteria, and suspended solids. Grazing by filter-feeding zooplankton such as Daphnia magna can significantly remove pollutants in treatment wetlands. Silver nanoparticles (AgNP) are widely used due to their antimicrobial properties. Plastics are also widely present in the environment and are broken down over time into microplastics (MP) and nanoplastics. The interactions between microplastics, AgNP, and filter-feeding zooplankton are unknown. Silver is toxic to aquatic organisms and understanding the impacts of this contaminant in conjunction with microplastics on zooplankton that are critical to treatment wetland function is necessary.

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SURF Abstract Submission & Post Program Survey 2020

Name	Marta Almazovaite
Year of Graduation	2024
SURF Advisor	Benita Jackson, Psychology
SURF Field of Study	Social Psychology
Please list co-authors of your abstract (if applicable)	Benita Jackson, Egypt Ballet, Lilit Danielyan, Suejona Miah, & Anna Peel

Title of Abstract/Research Built and Natural Environments Effects on Psychological Flexibility: Review of Literature and Study Designs

Please type your abstract below.

Recent studies show that even brief time in settings with nature (e.g., a park) increases cognitive function, compared to similar time spent with less nature-based elements (e.g., buildings; Nisbet & Zelenski, 2011). One important predictor of cognitive function that, to our knowledge, has yet to be linked to exposure to nature is psychological flexibility. Arguably a critical key common pathway to mental and physical health (Kashdan & Rottenberg, 2010), psychological flexibility is thus a psychological trait holding promise as a potent point of intervention. For this project we reviewed literature in support of developing empirical investigations to test if exposure to nature (v. built environments) is associated with greater psychological flexibility. We also seek to test for a unique association between nature exposure and psychological flexibility beyond related but different constructs (e.g., time perspective). Additionally, we identified potential pathways (e.g., awe), amplifiers (e.g. self-compassion), and dampeners (e.g., rumination) for the link between nature exposure and psychological flexibility, should it exist. We designed two sets of empirical examinations: a correlational study to test initial associations, and an experimental study, to test a replication and extension Nisbet and Zelenski's (2011) research on nature exposure and cognition, in our version, focusing on psychological flexibility as the dependent variable. Relevant to our increasingly online world, our extension will further investigate the effects of virtual exposure to natural and built environments on psychological flexibility. If such a link exists, this can lay groundwork for later intervention research testing the 'minimal nature dose' - including amount of time and type (in person v. virtual) - needed to boost psychological flexibility.

SURF Abstract Submission & Post Program Survey 2020

Name	Rose Sears
Year of Graduation	2022
SURF Advisor	Denise McKahn, Engineering
SURF Field of Study	Energy Engineering

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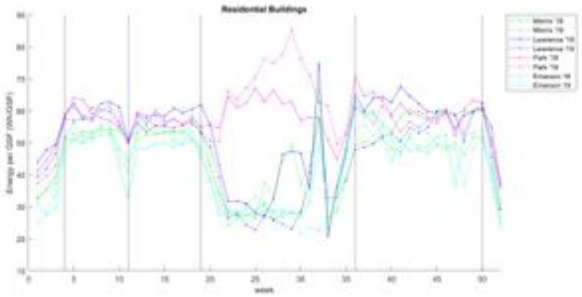

Title of Abstract/Research

Building Energy Consumption at Smith: pre-COVID, during COVID, and informing what's next

Please type your abstract below.

My research focused on building energy consumption of select Smith buildings by comparing pre-COVID energy consumption with the period during COVID in order to inform building energy management as we return to full operation. I started with power data, cleaned it, and calculated energy consumption on a weekly basis for each building for 2018, 2019, and 2020. In the pre-COVID data, I found that residential buildings had similar trends during the semester, were fairly similar during winter break and J-term, and were variable in the summer due to summer programming and occupancy levels. During 2020, there was a clear drop in mid-March, when the campus entered a shut-down mode. On a weekly basis, the residential buildings had a lower baseline energy consumption during COVID than during breaks before COVID. This means that in future break periods, the residential buildings can have reduced energy consumption, leading to energy savings. I calculated these energy savings to be equivalent to $49,000 to $55,000 in annual savings for all residential buildings ($0.045 to $0.051 per Gross Square Foot). These findings can be utilized by Facilities Management to prioritize reducing energy consumption in residential buildings during break periods.

I also researched sewage heat exchange systems in preparation for an Engineering Design Clinic project, as well as preliminary research related to the charging needs if/when Smith electrifies its fleet.

SURF Abstract Submission & Post Program Survey 2020

Name	Macy Kasbo
Year of Graduation	2022
SURF Advisor	Maren Buck, Chemistry
SURF Field of Study	Chemistry
Title of Abstract/Research	Protein-Polymer Conjugates

Please type your abstract below.

The conjugation of proteins to polymers has been a revolutionary discovery to the fields of science, medicine, and engineering. Coupling the biological functions of proteins to the chemical flexibility of synthetic polymers has important potential, specifically in terms of targeted drug delivery.(1) In the world of medicine, the lack of targeted drug delivery methods present great issues for chemotherapy, neurological diseases, and developing treatments for numerous unresolved illnesses.
Targeted drug delivery has made substantial improvements through both active and passive targeting methodologies.(2) Although many passive nanocarriers, such as antibody-drug conjugates, have been approved for clinical use, there remains challenges towards developing appropriate linkers between antibodies and their drug cargo and the need to further explore active drug carriers.1 Active targeted drug delivery is composed of a drug carrier, polymers, conjugated to a ligand, proteins. Nanocarriers offer great flexibility and can be designed to adapt to parameters and specific microenvironments through protein engineering and polymer functionalization. Functional polymers with a defined molecular weight, degree of functionalization, and precise location of the functional groups are an essential part of polymer synthesis.(3)
During my SURF experience, I had the opportunity to synthesize and functionalize polymers, conjugate polymers to proteins, troubleshoot different procedural issues, and learn how to use a variety of equipment to facilitate my research. SURF was a unique opportunity that allowed me to grow my experience in the lab as well as contribute data to the Buck lab. A substantial amount of my time was dedicated to synthesizing poly(2-vinyl-4,4-dimethylazlactone) (PVDMA), however, we discovered that PVDMA is more likely to hydrolyze and exhibit odd behavior when functionalized with alcohols. I conducted multiple functionalizations of PVDMA with alcohols like butenol, hexenol, and ethanolamine but PVDMA did not behave as expected. FTIR data demonstrate the odd behavior of alcohols coming off of PVDMA and azlactone rings reforming. Subsequently, I have started exploring poly(pentafluorophenyl acrylates), which has shown great potential for future studies and functionalizations.

(1)Buck, M.; Moore, S. Project Description. 1-15 (2020)
(2)Kim, J. S.; Sirois, R. A.; Cegla, A. J. V.; Jumai'an, E.; Murata, N.; Buck, M. E.; Moore, S. J. Protein Polymer Conjugates Synthesized Using Water-Soluble Azlactone-Functionalized Polymers Enable Receptor-Specific Cellular Uptake toward Targeted Drug Delivery. Bioconjugate Chem. 2019, 30, 1220-1231
(3)Das, A.; Theato, P. Multifaceted Synthetic Route to Functional Polyacrylates by Transesterification of Poly(pentafluorophenyl acrylates). Macromolecules. 2015, 48, 8695-8707

SURF Abstract Submission & Post Program Survey 2020

Name	Marge Poma Alarcon
Year of Graduation	2023
SURF Advisor	Jesse Bellemare, Biological Sciences
SURF Field of Study	Plant Biology
Title of Abstract/Research	Exploring the influence of red pigmentation over insect attraction in Sarracenia pitcher plants

Please type your abstract below.

Carnivorous plants are unique in their ability to extract nutrients from insects, an adaptation developed through a history of growth in nutrient-poor environments. There is much controversy, however, around the influence of insect attraction in pitcher plants. While some biologists claim that red pigmentation correlates with higher insect capture rates (Schaefer & Ruxton, 2008), others protest and believe nectar production to be the major influence (Bennett & Ellison, 2009). Under Prof. Jesse Bellemare's guidance, my colleague Sasha Zeidenberg and I gained some insight on the role of red pigmentation and possibly nectar glands in three pitcher plant species: Sarracenia flava, S. alata, and S. leucophylla.

All three species have some form of pigmentation ranging from intense red coloration and conspicuous veining to mostly green to even a genetic mutation that inhibits their production of anthocyanins, or red pigmentation, entirely. Experimental potted pitcher plants of these different colorations were exposed to natural wetland areas where they were arranged in side-by-side pairs with a time-lapse camera placed in front of them. Each time-lapse session resulted in a 3-4 hour video capturing: (1) what kinds of insects approached which plant, (2) how they interacted with each pair of color forms (red vs. green), (3) which color form was approached first, and (4) which color form received more visits and captures. Due to the short time frame this experiment took place, we were not able to reach definitive conclusions about which plant received the most visits/captures. However, we were able to further investigate the factor of nectar glands and sugar production through dissection and how they might influence insect attraction.

While the primary goal of this experiment is to explore the role of red pigmentation in Sarracenia pitcher plants, our overall hope is to strengthen the data behind all carnivorous plant research. The function of coloration in pitcher plants still remains a mystery, but the results of this investigation could prove to be a resource for many plant biologists and ecologists.

SURF Abstract Submission & Post Program Survey 2020

Name	Georgia Pharris
Year of Graduation	2022
SURF Advisor	Jack Loveless, Geosciences
SURF Field of Study	Geosciences

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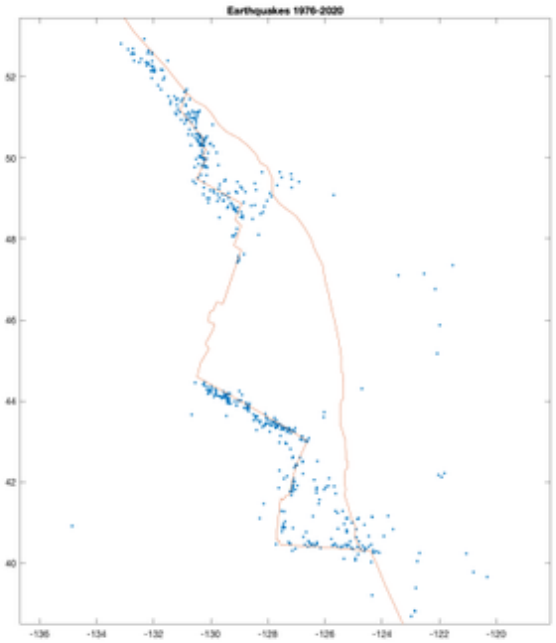

Title of Abstract/Research Juan de Fuca Plate Motion

Please type your abstract below.

The Juan de Fuca plate, a tectonic plate off the coast of the Pacific Northwest subducting under the North American plate, is difficult to track the movement of. Unlike other subducting plates, the Juan de Fuca plate is small and has no islands on which GPS stations could be placed. The most reliable method of tracking its movement is by analyzing seafloor spreading rates. However, although seafloor spreading rates are accurate, they are only capable of providing long-term data. Finding another method of constraining the motion of the Juan de Fuca plate could allow for shorter-term estimates and more accurate constraints.

For my project, I consolidated data from the Global Centroid Moment Tensor Database and the U.S. Geological Survey earthquake catalog to create composite earthquakes representing the movement during earthquakes at the Juan de Fuca-Pacific plate boundary. I was then able to convert the information on the composite earthquakes into velocity data, making it comparable to other velocity data. My work showed that it is possible to convert earthquake data into velocity data, which will be useful as I work on my thesis.

SURF Abstract Submission & Post Program Survey 2020

Name	Yuqi Wang
Year of Graduation	2024
SURF Advisor	David Bickar, Chemistry
SURF Field of Study	Chemistry
Please list co-authors of your abstract (if applicable)	Linnea Schultz

Title of Abstract/Research Quantifying Dopamine Through Dansylation and Purification Analysis

Please type your abstract below.

Parkinson's disease is a neurodegenerative disorder that causes dopamine (DA) deficiency due to decreased dopaminergic neurons. By developing a procedure to quantify salivary dopamine concentration, the lab aims to explore a potential Parkinson's diagnostic metric. Dansylation is performed to prevent oxidation and increase the size and charge of the molecule, so it can be better quantified through mass spectrometry (MS). During the summer the lab focused on reacting dansyl chloride with DA and its metabolites homovanillic acid (HVA), 3,4-Dihydroxyphenylacetic acid (DOPAC), and 3-Methoxytyramine (3-MT). The fluorescence and absorbance of dansylated dopamine and its derivatives were examined, which confirmed the reaction and purification procedures and provides information for future quantification using MS.

Water and ethanol were both used as solvents for spectroscopy, but ethanol was used for all compounds because of its lesser polarity. This allowed comparison of the wavelengths at which maximum absorbance and fluorescence were achieved across all compounds. The smallest molecule, hydrolyzed dansyl (dansOH), had the lowest λ-maxes: 455 for fluorescence and 300 for visible light. dans-DOPAC and dans-HVA had the highest λ-maxes: 524 for fluorescence and 352 for visible light and 525 for fluorescence and 345 for visible light, respectively. dans-3-MT was intermediate with 510 for fluorescence and 340 for visible light, and dans-DA had the lowest λ-maxes of the dopamine derivatives with 506 for fluorescence and 336 for visible light. These values seem to loosely follow a pattern, with the portion of the molecule made up of dansyl groups correlating with lower λ-maxes. However, some of these values are also so close together that it would be difficult to differentiate between compounds in a mixed sample.

Standard samples were weighed after drying to determine product yield. Comparison between theoretical and practical yield gave overall reaction yield for d-dopamine: 104%, d-HVA: 80%, d-DOPAC: 76%, and d-3-MT: 81%, averaging to 85.25% yield. Prior to drying, standards were characterized through fluorescence and UV-Vis spectroscopy to determine which fractions were most pure, which were then included.

Streamlining and improving the procedure remains important. However, with successful purification and characterization procedures, the project could be expanded into the clinical realm of collecting salivary samples from individuals with and without Parkinson's to determine the relative ranges of salivary dopamine concentration.

SURF Abstract Submission & Post Program Survey 2020

Name	Emma Lesser
Year of Graduation	2022
SURF Advisor	Niveen Ismail, Engineering
SURF Field of Study	Engineering
Please list co-authors of your abstract (if applicable)	Noor Sheikh, Maddie Davis, Piper MacDonald

Title of Abstract/Research Fate and Impacts of Silver Nanoparticles and Microplastics on Daphnia magna in Treatment Wetlands

Please type your abstract below.

Treatment wetlands for water purification are typically designed to allow for various physical and biological processes that reduce levels of organic contaminants, metals, bacteria, and suspended solids. Grazing by filter-feeding zooplankton such as Daphnia magna can significantly remove pollutants in treatment wetlands. Silver nanoparticles (AgNP) are widely used due to their antimicrobial properties. Plastics are also widely present in the environment and are broken down over time into microplastics (MP) and nanoplastics. The interactions between microplastics, AgNP, and filter-feeding zooplankton are unknown. Silver is toxic to aquatic organisms and understanding the impacts of this contaminant in conjunction with microplastics on zooplankton that are critical to treatment wetland function is necessary.

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SURF Abstract Submission & Post Program Survey 2020

Name	Julia Walker
Year of Graduation	2022
SURF Advisor	Sarah Mazza, Geosciences
SURF Field of Study	geosciences
Title of Abstract/Research	Geochemical analysis of Jurassic gabbros and syenites from the White Mountains, New Hampshire

Please type your abstract below.

The White Mountains are composed of a series of plutons and associated extrusive igneous rocks located in New Hampshire and the westernmost part of Maine. The White Mountains have experienced two periods of magmatism: the older period occurred approximately 200-165 Mya and the younger period approximately 130-100 Mya. The Jurassic pulse of magmatism may be associated with the rifting of Pangea 200 Mya and the subsequent opening of the North Atlantic Ocean, but the petrogenetic processes behind the Jurassic magmatism are not well understood. Eby et al. (1992) propose that magmas derived from a non-crustal source underwent two periods of fractional crystallization, an earlier period at the base of the crust and a later period in the shallow crust. The Cretaceous magmatism is thought to be associated with the Great Meteor Hotspot, a mantle plume that begins in the Monteregian Hills in Quebec and extends out into the New England Seamounts in the Atlantic Ocean.

Previous studies suggest that the Jurassic White Mountains magmatism is an example of A-type granitoid magmatism with an ocean island basalt source (Eby et al., 1992). However, the White Mountains have not been studied extensively, especially in recent years. Many of the units have yet to be well characterized, mapped, and/or dated. We seek to characterize a suite of samples related to the period of Jurassic magmatism, including samples mapped as Jurassic gabbros and syenites (Lyons et al., 1997). The gabbro stock from the Three Ponds area in New Hampshire is characterized as having a mineral assemblage of plagioclase + biotite + hornblende ± augite, with previous studies suggesting that the hornblende is secondary (Malinconico et al., 2012). The porphyritic syenite from the Passaconaway area is characterized as having a mineral assemblage of alkali feldspar + plagioclase + oxides + biotite ± pyroxene ± amphibole. Because the Three Ponds gabbros and Passaconaway syenites were not included in the work of Eby et al. (1992), their geochemistry has not been explored in detail. We present whole rock geochemical data and mineral chemistry for these samples with the goal of better understanding the petrogenetic processes associated with magmatism during the Jurassic and how that fits into the regional context of the tectonic history of New England.

SURF Abstract Submission & Post Program Survey 2020

Name	Yeji Lee
Year of Graduation	2022
SURF Advisor	Sarah Moore, Chemistry
Secondary SURF Advisor	Alexis Ziemba Chemistry
SURF Field of Study	and Biology

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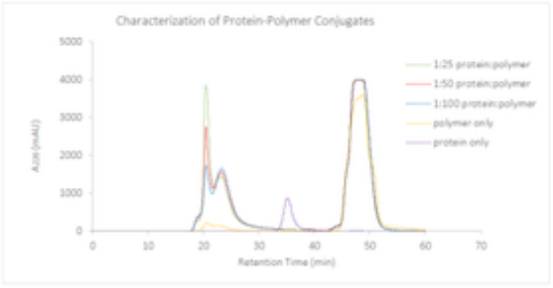

Figure 1 Elution times of contents in protein-polymer conjugate mixtures at A_{220}, which indicates the presence of amide bonds.

Title of Abstract/Research

Characterization of Fn3-PVDMA Conjugates Synthesized via Primary Amine-Azlactone Chemistry

Please type your abstract below.

Targeted drug delivery promotes drug interactions with diseased cells to prevent uptake of toxic therapeutics by healthy cells. Two examples of where targeted delivery can substantially improve clinical outcomes are for cancer patients and for transporting drugs into the brain across the blood-brain barrier. This summer, I synthesized protein-polymer conjugates (PPCs) as targeted drug delivery molecules. I used high binding affinity fibronectin type III (Fn3) proteins that can selectively recognize and bind to integrin receptors overexpressed in cancer cells and poly(2-vinyl-4,4-dimethyl-azlactone), a reactive polymer that can conjugate to proteins via primary amine chemistry and would carry therapeutic drugs. My next goal was to optimize conjugation efficiency and assess efficiency using SDS-PAGE gels. A major indication of conjugation were reduced Fn3 monomer bands at ~11 kDa when PPC samples were run. The densities of the reduced monomer bands were quantified and compared to that of the protein-only control monomer band using ChemiDoc Imaging System to approximate the percentage of conjugation in different protein-to-polymer ratios tested. The software analysis found that 1:25 protein-to-polymer ratio resulted in the highest conjugation percentage. More importantly, the concentration of polymer in DMSO before mixing with protein significantly impacted conjugation efficiency with improved conjugation when polymer was more concentrated. Next, the conjugate mixtures were purified and characterized using size exclusion chromatography. Conjugates, which are the largest, were expected to elute first. From previous works, Fn3 proteins and polymers typically elute at ~35-40min and ~45-55min, respectively. As shown in Figure 1, all three conjugate samples had polymers in excess, negligible amounts of unreacted proteins, and a range of peaks at ~20-30min, supporting the presence of protein-polymer conjugates. The small peaks at ~20-30min for the polymer control may indicate contamination or aggregation as a result of storing in a low temperature, hydrophilic environment for three months. The conjugate with 1:25 protein-polymer ratio had the largest area under the curve at ~20-30min and the highest conjugation efficiency, supporting the data from the gel. The next step is to distinguish three peaks in the ~20-30min range using MALDI. My hypothesis is that the peaks at ~17min, ~21min, and ~24min represent conjugates consisting of three protein monomers and one polymer chain, two proteins and one polymer, and one protein and one polymer, respectively, as a larger molecular size results in an earlier elution time.

SURF Abstract Submission & Post Program Survey 2020

Name	Sophia Chertock
Year of Graduation	2022
SURF Advisor	Steve Williams, Biological Sciences
SURF Field of Study	Biochemistry

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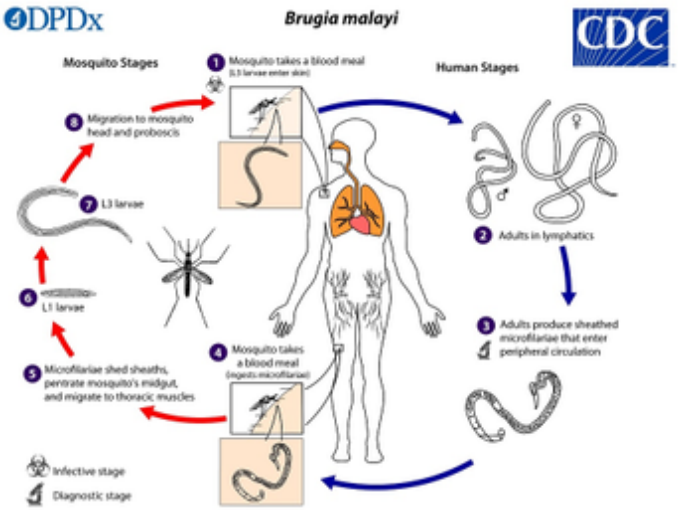

Title of Abstract/Research

Transfection of Brugia Malayi for Lymphatic Filariasis Research

Please type your abstract below.

There is an ongoing worldwide effort to eradicate lymphatic filariasis (LF), which is classified as a Neglected Tropical Disease due to its disproportionate ratio of research to the number of individuals afflicted (i.e., 120 million people in 72 countries). Mosquitos carrying the human filarial parasites Wuchereria bancrofti, Brugia malayi, or B. timori transmit these microscopic worms upon obtaining a blood meal. The filariae live within the human lymphatic system, and can block lymph drainage, debilitating those affected, contributing to a cycle of poverty and disease. There are several effective drugs against LF, but they are limited in supply, must be given repeatedly over long periods, and require a logistically difficult and expensive distribution process. The use of reverse genetic techniques has been identified by our collaborator, Thomas Unnasch, PhD, at the University of South Florida, as an essential tool for both developing new treatments as well as recognizing drug resistance pathways. This summer, I tested out the Unnasch Lab protocol for an integrative transgenesis technique in Brugia malayi using the piggyBac heterologous transposon-based system. Using both a helper transposase plasmid pBmCDTH, which is not incorporated into the genome, and a transposon plasmid, pBACII-BmGluc-MCS, encoding GLuc, a luminescent selectable marker, I aimed to confirm presence of the transgenic locus in L3 stage B. malayi. I obtained 300 L3 stage B. malayi from the Filarial Research Reagent Resource Center at the University of Georgia, which were placed on a 24-well plate pre-seeded with BESM cells at 70-90% confluence. Two wells with L3s were given transfection reagents, and the two negative control wells either contained L3s without transfection micelles, or contained transfection reagents without L3s. The transfection utilized Lipofectamine LTX reagent to create micelles within which the plasmid constructs could be integrated into the genome. For each 8-day experiment, lipofection reagents were added to L3 media, which was later screened for secreted luciferase using a luminometer and Stop & Glo buffer and reagents. On the fifth day, molting was induced with ascorbic acid. In contrast to Unnasch's article, no luminescence was detected in the media in any of my repeated experiments, indicating that no transfection took place. Many labs testing this protocol have retained results similar to mine. My thesis plans involve optimizing the Unnasch lab's similar protocol which involves CRISPR in the place of piggyBac, and seems to be more effective in integrating the GLuc gene.

SURF Abstract Submission & Post Program Survey 2020

Name	Miranda Wu
Year of Graduation	2022
SURF Advisor	David Gorin, Chemistry
SURF Field of Study	Chemistry

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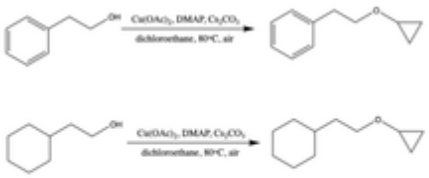

Scheme 1. Cyclopropylation of aliphatic alcohols via Molander conditions + base (cesium carbonate)

Title of Abstract/Research Cyclopropylation of Aliphatic Alcohols using Cyclopropylboronic Acid

Please type your abstract below.

Alkylation of organic molecules is often used in pharmaceutical chemistry to produce organic compounds. However, existing reagents used for alkylation are toxic and require harsh reaction conditions. These reagents are often electrophiles such as methyl iodide, dimethyl sulfate, or diazomethane, and exposure to such electrophiles has resulted in multiple deaths. Due to the importance of alkylation in drug development, yet the dangers associated with reagents typically used for alkylation, my research this summer focused on finding safer ways to oxygen-alkylate molecules. Instead of using electrophilic alkyl sources, I used cyclopropylboronic acid, which is a nucleophile. This nucleophilic alkyl source poses significantly less risks than the aforementioned electrophilic reagents. Cyclopropylation of aliphatic alcohols using cyclopropylboronic acid showed promising results. I used reaction conditions adapted from Molander conditions. These conditions included the addition of a base -- cesium carbonate (Scheme 1). The addition of a base is predicted to aid in product formation via a proposed mechanism where deprotonation of the alcohol group occurs. GCMS data of the reaction after running for 24 hours showed peaks that indicate possible product formation. A side product in which acetylation of the alcohol occurred instead of the desired cyclopropylation product may have also formed. To eliminate the formation of the acetate product and further confirm desired product formation, copper trifluoroacetate was utilized as the copper catalyst in one reaction instead of copper acetate. Analysis of this reaction showed the same possible product peak found in the original reaction conditions. Further analysis of the data, however, is needed to confirm the formation of the cyclopropylated product. Future directions will work to identify whether these peaks are from the desired product or from other side products.

SURF Abstract Submission & Post Program Survey 2020

Name	Clare O'Connor
Year of Graduation	2022
SURF Advisor	Gregory de Wet, Geosciences
SURF Field of Study	Geosciences (Paleoclimatology)
Title of Abstract/Research	Investigation of brGDGT sources in Paradise Pond

Please type your abstract below.

In recent years, a group of bacterial membrane lipids called branched glycerol dialkyl glycerol tetraethers (brGDGTs) has emerged as a promising paleotemperature proxy in lake sediment cores. A relationship between temperature and the degree of methylation of these brGDGTs has been shown, but many questions about their applicability remain. Since brGDGTs may originate in either watershed soils or within the lake itself, it is necessary to determine the main source of these biomarkers in order to accurately reconstruct temperature from lake sediment cores. This requires creating a lake-specific calibration based on current temperature and amount of brGDGTs in the lake and surrounding watershed soils. The purpose of this project was to investigate the modern relationship between brGDGT production and temperature in Paradise Pond. We collected soil samples from six locations around Paradise Pond, as well as surface sediment samples from the bottom of the pond in three different locations. These samples will be analyzed via organic biogeochemical analysis at the UMass Biogeochemistry Lab. The data collected as part of this project will contribute to furthering the understanding of how brGDGTs may be applied as a paleotemperature proxy for paleoclimatic reconstructions globally.

SURF Abstract Submission & Post Program Survey 2020

Name	Dashelle Gleissner
Year of Graduation	2022
SURF Advisor	Sarah Witkowski, Exercise and Sports Studies
SURF Field of Study	Exercise and Sports Studies
Title of Abstract/Research	The affect of physical activity on menopausal symptoms

Please type your abstract below.

In the Vascular Function Lab run by Dr. Witkowski, I worked on two projects related to the lab's research focused on menopause and its relation to cardiovascular disease risk. Cardiovascular disease risk will increase to a greater degree during the transition to and beyond menopause than at other times in a person's life. Menopause can be experienced by multiple people including cis-gendered women, transgender men, non-binary, and intersex people.
One project involved methodology refinement for a longitudinal study that tracks menopause symptom experience and physical activity behavior in individuals aged 40-65 with the goal of evaluating relationships between these factors as people move from pre- to peri- and post-menopausal stages.The Questionnaire is sent yearly and it includes questions about demographics, physical activity levels, obstetrical history, as well as physical and mood-related symptom experience. As this project is a large undertaking, and will require robust database capacity, I worked on trying to smoothly transfer the questionnaire and data from Qualtrics to REDCap. In addition to learning and designing a REDCap database for the study, I also screened and enrolled participants.
The second project is designed to study the relationships between physical activity and hot flashes in perimenopausal individuals aged 43-54. Hot flashes in perimenopausal women have been associated with cardiovascular disease risk. However the impact of habitual physical activity on this relationship is unknown. This study includes 3 visits to the Vascular Function Laboratory where we conduct a series of measurements for data collection. A screening visit consists of measures of cardiovascular disease risk factors, cardiorespiratory fitness and objective physical activity measures. If participants qualify, a second visit is designed to measure objective and subjective hot flash experience and objective physical activity over 24 hours. During this condition, participants can not exercise. A third visit is designed to assess CVD risk via blood vessel function and a second 24-hour hot flash and physical activity monitoring period after a 30-minute bout of exercise.This summer I helped conduct these visits and interacted with the participants. I learned how to measure arterial stiffness via pulse wave analysis and velocity and measure blood vessel function via flow mediated dilation.I helped manage the data and ensure data quality and security.

SURF Abstract Submission & Post Program Survey 2020

Name	Hope Pungello
Year of Graduation	2022
SURF Advisor	Julianna Tymoczko, Mathematics and Statistics
SURF Field of Study	Mathematics
Please list co-authors of your abstract (if applicable)	Joy Mahoney, Jessie Cai, Tayler Fernandes Nunez, Saraphina Forman, Ruoxi Li, Claire Yun

Title of Abstract/Research Database Report for Generalized Splines on Dual Graphs to Triangulations

Please type your abstract below.

Splines are a fundamental tool across applied mathematics and analysis, used in areas such as computer graphics, engineering models, and data interpolation. Our research considers an algebraic-combinatorial generalization of splines on edge-labeled graphs. In this context, a spline is a vector of vertex-labels such that labels of vertices that share an edge differ by a multiple of the shared edge-label. All possible splines on an edge-labeled graph form a vector space known as the “spline space.” This report describes a database being developed to aid study of the basis of the spline space of graphs with real or complex polynomial edge-labels of degree 2. Of particular interest is how the dimension of basis elements with all entries of degree < 3 varies from graph to graph -- a question that is central to a long-standing open problem colloquially known as the ``Upper Bound Conjecture." All graphs in this database are connected graphs with vertex-valence at most three, a subset of which are dual to a planar triangulation. All variables describe one of three aspects of an edge-labeled graph: structural qualities, the edge-labels, or the spline space basis. The graphs are not a random sample, but rather were chosen as families created by varying a particular structural quality of a some "base" graph. Theoretically, if the database is robust enough, interaction patterns between variables may be isolated by comparing the variation of the basis variables within and across many such families over many edge-label sets. Such results may have potentially fruitful lessons for more abstract approaches to this problem. However, the database currently lacks such robustness. Thus, this report was written with three uses in mind: a guide for using the database as-is, an instruction manual for building the database, and a primer and overview of steps for completing the final database and conducting data analysis.

SURF Abstract Submission & Post Program Survey 2020

Name	Tetiana Novosolova
Year of Graduation	2024
SURF Advisor	Michael Barresi, Biological Sciences
SURF Field of Study	Neuroscience
Please list co-authors of your abstract (if applicable)	Emma Whittemore, Nellie Ayala

Title of Abstract/Research The Role of Cranial Neural Crest Cells in the Developing Forebrain

Please type your abstract below.

Neural Crest Cells (NCCs) are known as STEM cells of a nervous system that migrate out of the neural tube infiltrating structures outside of the central nervous system. In Barresi Lab, we are attempting to challenge this conventional statement using zebrafish as a model. Over this summer, we were able to demonstrate that a small population of NCCs goes back to the CNS and infiltrates the forebrain region at or right before the time of forebrain commissures formation using sox10 as a molecular marker of NCCs. Besides that, we were attempting to compare the expression patterns of metrn and metrnl (two paralogs of meteorin gene) with traces of NCCs as well as with radio glial cells population since meteorin is a morphogen known for its role of regulating radio glial cells development and paths. Aiming to reach our long-term goal, I was able to learn and practice a set of standard lab procedures like in situ hybridization, embedding, cryosectioning, RNA probe synthesis, immunocytochemistry on sections, as well as brightfield, fluorescent, and confocal microscope imaging, which allowed us to see metrn expression in the central mesoderm of the neural tube and in the anterior forebrain region. The preliminary data were presented at the Annual Conference of the Society for Developmental Biology 2021. Our further steps for the upcoming semester will include lineage studies with the application of molecular markers to track NCCs population as the expression of sox10 is lost, fate mapping, and single-cell transcriptomics in the context of neural crest and forebrain development.

SURF Abstract Submission & Post Program Survey 2020

Name	Andreea-Bianca Morecut
Year of Graduation	2023
SURF Advisor	Jordan Crouser, Computer Science
SURF Field of Study	Computer Science
Title of Abstract/Research	HCV Lab Projects

Please type your abstract below.

My work this summer was spread over two projects. The first project was focused on suggestions, how to offer them to users and everything that goes into the suggestion process, and the second one was centered around running user studies and analyzing data regarding human-computer interaction as the user worked their way through a challenge.

Throughout the first part of my work for the first project, my teammates and I went through several academic articles, making sure we had the research background needed to actually pick the changes we wanted to implement. We read articles, summarized them, and reported to our supervisor regularly. On the way, we compared what we had to the already existing draft of the interface and took notes on what could be improved. Towards the end of the SURF period, we started coding the changes in and got a few rounds of feedback from casual user studies. We were able to make changes to the sidebar, the functionality of the buttons, as well as the filters that showed up as suggested. Along the way, we took notes accordingly and I also became more familiar with JavaScript, HTML, CSS, and what exactly goes into the backend and frontend of programming projects.

For the second project, I started out running user studies on the interface, studying the way people interacted with the challenge they were given, with two separate purposes: firstly, to test the functionality of the interface, but also secondly, to contribute to what area of research the interface was for in the first place. For the latter part of this project, I analyzed a folder of 100 entries from an older challenge that was cataloguing the notes that the participants in the project wrote down. This was one of my first significant data analysis experiences, and I learned a lot about how to leave instructions behind for the next person and how to navigate, adapt, and optimize digging through the files.

SURF Abstract Submission & Post Program Survey 2020

Name	Gabrielle Mingolelli
Year of Graduation	2022
SURF Advisor	Lesley-Ann Giddings, Chemistry
SURF Field of Study	Chemistry
Please list co-authors of your abstract (if applicable)	Asiya Karim

Title of Abstract/Research Expression and Kinetic Characterization of SsDesB Mutants

Please type your abstract below.

Desferrioxamine B is used clinically to treat iron overload disorders via chelation. The iron siderophore is biosynthesized by the desABCD gene cluster. With the exception of DesA, the catalysis mechanisms of the enzymes encoded by the cluster are unclear. DesB is responsible for the N-hydroxylation of cadaverine, a desferrioxamine B precursor, and has many homologs in clinical pathogens. Thus, understanding both the characteristics and kinetic mechanism of DesB could improve production of desferrioxamine B and its derivatives. Our project expanded on previous work from the Giddings lab to characterize the catalysis of SsDesB from Streptomyces sviceus. We studied three mutations that were introduced to the desB gene to complete a comparative study of the kinetic parameters and substrate scope of the enzyme.

We designed three primer sets for site-directed mutagenesis of SsDesB within a pet28a(+) plasmid, two of which produced successful mutants. Successful mutants were cultured and extracted DNA was sequenced. Sequence alignment confirmed the mutations and these genes will be expressed in E.coli for future experimentation.

We performed colorimetric assays, including a modified Csaky to observe changes in iodine oxidation in relation to SsDesB product formation. Using NAD(P)H assays, we confirmed activity of the S66K mutant, but not the R223A mutant. Based on work by Dr. Giddings, the Csaky assay was first performed with 0.055 mg/mL enzyme. However, this concentration did not provide significant data for the initial rate. To determine the optimal enzyme concentration for 10% turnover, we designed a single well Csaky which confirmed wild-type and D391A enzyme activity. S66K notably had no significant activity in the Csaky experiments. A Csaky was performed at 0.11mg/mL enzyme, however, these results cannot be used for a Michaelis-Menten plot because the turnover exceeded 10%. We will further modify the Csaky assay to observe the desired turnover and the two novel SsDesB mutants in comparison to the wild-type and D391A enzymes.

Lastly, we designed a colorimetric pH assay for DesA activity based on a glutamate decarboxylase pH assay. We were not able to observe significant changes in absorbance compared to the blank under the chosen conditions. Samples of the reaction were sent to UMass Amherst for LCMS analysis to confirm activity. The results showed no activity because there was no decarboxylase product peak. Significant changes to the assay are necessary including an alternative desA gene.

References:

Giddings L-A, Lountos GT, Kim KW, Brockley M, Needle D, Cherry S, et al. (2021) Characterization of a broadly specific cadaverine N-hydroxylase involved in desferrioxamine B biosynthesis in Streptomyces sviceus. PLoS ONE 16(3): e0248385. https://doi.org/10.1371/journal.pone.0248385

Yu K, Hu S, Huang J, Mei LH. A high-throughput colorimetric assay to measure the activity of glutamate decarboxylase. Enzyme Microb Technol. 2011 Aug 10;49(3):272-6. doi: 10.1016/j.enzmictec.2011.06.007. Epub 2011 Jun 12. PMID: 22112511.

SURF Abstract Submission & Post Program Survey 2020

Name	Asiya Karim
Year of Graduation	2023
SURF Advisor	Lesley-Ann Giddings, Chemistry
SURF Field of Study	Biochemistry
Please list co-authors of your abstract (if applicable)	Gabby Mingolelli

Title of Abstract/Research Expression and Kinetic Characterization of SsDesB Mutants

Please type your abstract below.

Desferrioxamine B is clinically used to treat iron overload disorders via chelation. The iron siderophore is biosynthesized by the desABCD gene cluster. With the exception of DesA, the catalysis mechanisms of the enzymes encoded by the cluster are unclear. DesB is responsible for the N-hydroxylation of cadaverine, a desferrioxamine B precursor, and has many homologs in clinical pathogens. Thus, understanding both the characteristics and kinetic mechanism of DesB could improve production of desferrioxamine B and its derivatives. Our project expanded on previous work from the Giddings lab to characterize the catalysis of SsDesB from Streptomyces sviceus.1 We studied three mutations that were introduced to the desB gene to complete a comparative study of the kinetic parameters and substrate scope of the enzyme.

We designed three primer sets for site-directed mutagenesis of SsDesB within a pet28a(+) plasmid, two of which produced successful mutants. Successful mutants were cultured and extracted DNA was sequenced. Sequence alignment confirmed the mutations and these genes will be expressed in E.coli for future experimentation.

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SURF Abstract Submission & Post Program Survey 2020

Name	Pratima Niroula
Year of Graduation	2023
SURF Advisor	Mary Harrington, Neuroscience
SURF Field of Study	Neuroscience
Title of Abstract/Research	Broken Brain Clock II and Patch Test

Please type your abstract below.

For the first part of the SURF project, me and my lab mates revised a previous study. We selected four mice. Two of the mice had a broken SCN, the central clock of the body and the other two had an intact SCN. We put the mice in a constant dark condition for 28 days and measured their body's rhythmicity with bio-illuminance. The aim was to see how rhythmicity in the peripheral clocks in the body (the liver, heart, skin, etc) behaves when the SCN is non-functional. The previous Broken Brain Clock study was conducted over 7 days, which might have been too little time for the peripheral clocks to show their nature. The surgery might have provided a reference point for the peripheral clocks and the results might have been skewed. Therefore, we extended the study to 28 days so as to remove the effect of the surgery.

The second part of the SURF project had to do with exploring alternatives to surgery. Typically, surgery is used to deliver substrates but this procedure can be invasive and could skew the data. We tried to use skin patches to deliver the substrate instead. We tried various methods of application and measured the bio-illuminance we got from each application.

Aside from the two projects, I also learned about selecting strains of mice to breed for line-preservation and experiments. I learned about proper record-keeping and routine maintenance. I learned to look at genotype results of mice and conclude if they were experimental, control or line-preservation group.

SURF Abstract Submission & Post Program Survey 2020

Name	Junyang Li
Year of Graduation	2022
SURF Advisor	Maren Buck, Chemistry
Secondary SURF Advisor	Kate Queeney, Chemistry
SURF Field of Study	Chemistry
Please list co-authors of your abstract (if applicable)	Leila Yan

Title of Abstract/Research Reproducibly Tailor Surface Wettability via Reactive PVDMA Films

Please type your abstract below.

Our goal for SURF is to use reactive polymer films to tailor surface chemistry and create reproducible surfaces with tunable wettability. For the first part, we focused on the synthesis, functionalization, and characterization of PVDMA (2-vinyl-4,4'-dimethyl azlactone). To polymerize PVDMA, two methods with different chain transfer agents, 2-(dodecylthiocarbonothioylthio)-2-methylpropionic acid (DDMAT) and benzyl propyl trithiocarbonate (BPTC), were utilized. 1H NMR was used to calculate percent conversion in the polymerization process and BPTC was found to yield a higher percent conversion over the course of 8 hours. Precipitation proceeded immediately after the completion of polymerization, and it was found that the overall yield of PVDMA polymer is low for both chain transfer agents. Additionally, we deposited smooth thin films using the layer-by-layer approach. To help PVDMA adhere to the surfaces, we first attached a layer of PAH (polyallylamine hydrochloride) which sticks to the negatively charged SiO_2 surfaces through electrostatic interactions. Film thickness and contact angles were measured after depositing each layer.

SURF Abstract Submission & Post Program Survey 2020

Name	Ziyue Yang
Year of Graduation	2023
SURF Advisor	Stylianos Scordilis, Biological Sciences
SURF Field of Study	Myogenesis
Title of Abstract/Research	Cytoskeletal protein changes during myogenesis

Please type your abstract below.

Myogenesis is the formation of skeletal muscular tissue, particularly during embryonic development. Muscle fibers are the individual contractile cells within the muscle, formed through the fusion of myoblasts.
C2C12 cells were cultured and extracted during different stages of myogenesis (day 0, proliferating mononuclear cells; day 5, early myotubes – binucleate to several nuclei-containing cells that have exited the cell cycle and are initiating myofibrillar synthesis; and day 9, multinucleate non-diving cells that are forming contractile bundles and can twitch spontaneously in culture). Protein extract concentrations were determined by Lowry assay (Lowry et al., 1951). To further investigate the types of proteins, as well as their relative abundances, SDS-page gel electrophoresis (Laemmli, 1970) and immunoblots (Towbin et al., 1979) were employed.
Beta-tubulin is a component of microtubules, which forms part of the cytoskeleton and provides structure and shape to eukaryotic cells. According to my observations, the abundance of beta-tubulin increased during the three stages of myogenesis that were studied.
Another significant part of the SURF program was troubleshooting an aspect of the immunoblotting protocol. When probing some blots seemingly random "speckles" showed up in them. The presence of speckles indicates some sort of protein aggregation. We went through the lab immunoblot protocol and used the process of elimination to check each step in the protocol. We found that the speckles were caused by the unfiltered blocking buffer. The purpose of blocking is to prevent antibodies from binding to the PVDF membrane nonspecifically. By filtering the blocking buffer through Whatman No. 1 paper, the speckles disappeared.
We also had the chance to participate in the MaxQuant summer school and practiced hands-on training in computational analysis of proteomics data generated by modern mass spectrometers via MaxQuant and Perseus software.