2020

Summer Research Fellowship Project Descriptions 2020

Clark Science Center's Summer Research Fellows Program

2020 SURF Project Descriptions

SURF Abstract Submission & Post Program Survey 2020

Name   Abigail Smith

Year of Graduation   2020

SURF Advisor   Jackson, Benita

SURF Field of Study   Psychology

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

Benita Jackson, Olivia Pomeroy, Stephaney Perez, Uzma Malik, Emma Westgate, Alina A. I. Barylsky, Egypt Ballet, Abby Smith, & Isabel Schroedel

Title of Abstract/Research

Translating Psychological Science to the Public: Re-framing "Rest" As Central to Social Change

Please type your abstract below.

The first half of 2020 was marked by a global pandemic and social and political upheaval. With the additional backdrop of the climate crisis, there is much need for coalition building to address the factors that divide social groups. And yet, it remains unclear the most effective and efficient ways to resource, grow, and connect needed social movements when there are so many possible actions to take. A first response might be to "do more!" But, following from research in the varied domains of health, cognitive function, productivity, organizational behavior, and sociology, we see that planned fallow periods are perhaps counter-intuitively what best cultivate physical, mental, behavioral, and societal well-being. Our team culled and vetted more than 100 audio talks, and for each talk, identified key persuasive passages and multiple accompanying academic research articles in a project to "give psychology away." Specifically, we gathered the raw materials needed to create an outward facing translational project of science for the greater public promoting the notion of "resting to rise." Erica Chenoweth, human rights and international affairs expert, has data in support of the "3.5% rule"- that it takes only a small portion of a population facing in the same direction to make non-violent change of its government. Our goals are, via message framing and repetition, to persuade listeners that the concept and practice of rest will not only confer benefits for their personal and collective well-being, but must be central to them. The work our team completed this summer builds a key foundation toward these ends.

SURF Abstract Submission & Post Program Survey 2020

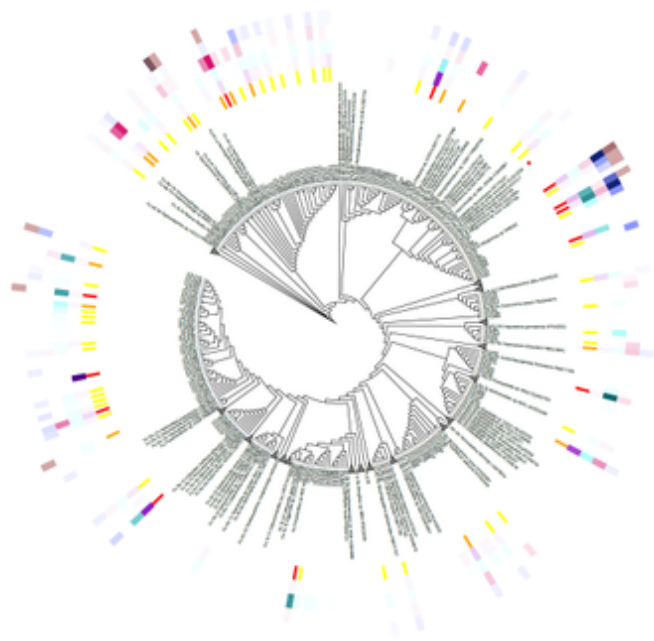**Name**   Adena Collens

Year of Graduation   2021

SURF Advisor   Katz, Laura, Biological Sciences

SURF Field of Study   Genetics, biodiversity

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

Title of Abstract/Research　　Exploring the Biodiversity of Foraminifera Communities

Please type your abstract below.

Environmental microbial communities are essential to the ecology of animals and their relationship to their surroundings. Amplicon SSU rDNA sequencing allows us to characterize microbiomes, as SSU rDNA sequences serve as unique barcodes for each potential species in an environment. This novel technique reveals new information about the diversity and ecology of uncultivable lineages that would otherwise be overlooked in previous morphology-based studies. However, many of these 'universal' barcoding techniques leave behind several rapidly-evolving lineages and therefore are not capturing the complete diversity of a microbial environment.

Foraminifera, the focus of this study, are an important group of microbes that are not captured by universal barcoding methods. Foraminifera are single-celled eukaryotes that significantly contribute to the global carbon cycle, as many species take up environmental carbon to create their ornate shells. While planktonic foraminifera have been well studied, little is known about their benthic or soil-dwelling relatives that live between sediments or attached to substrates.

This study is a preliminary analysis of several samples collected using these foraminifera-specific primers to understand their ecology across four different environments: salt marsh, tide pool, fish tank, and soil, and between several invertebrate animal hosts within the marine environments including snails, crabs, and clams. First, the SSU rDNA sequences were filtered for quality and clustered by similarity to create operational taxonomic units (OTUs), that function as potential species in my analysis. Then, I began to parse out their identities by situating my unknown OTUs within a phylogenetic tree of known foraminifera SSU sequences for reference. To better understand the differences between ecologies and animal associated-foraminifera communities, I also used biodiversity plots to analyze these data in R Studio, including principal coordinate analysis plots using UniFrac distances, Shannon and Simpson

plots, and other community data visualizations.

This preliminary analysis revealed several important insights and questions for future work. Excitingly, some abundant OTUs present on the animal shells in the fish tanks are closely related to Cibicides foraminifera documented to reside on clam shells in many morphology studies. In addition, several OTUs present in the soil samples taken outside Smith's Lyman Plant House match closely to soil foraminifera sequences previously published in the literature. So far, it appears that community diversity is more dependent on abiotic environmental factors than specific hosts, but I plan to further investigate this

SURF Abstract Submission & Post Program Survey 2020

Name	Ahlenne Abreu
Year of Graduation	2022
SURF Advisor	Scordilis, Stylianos; Biological Sciences
SURF Field of Study	Proteomics

Upload image(s) in .png format; 1,100 MB max size each
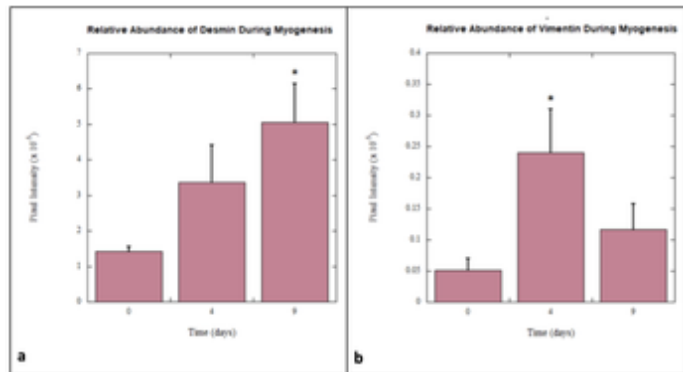
Figure 1. a) Desmin (n= 5; for each stage) protein abundance (pixel intensity), normalized to total stain on the gel, b) Vimentin (n= 5; for each stage) protein abundance (pixel intensity), normalized to total stain on the gel, * = significant at p < 0.05.
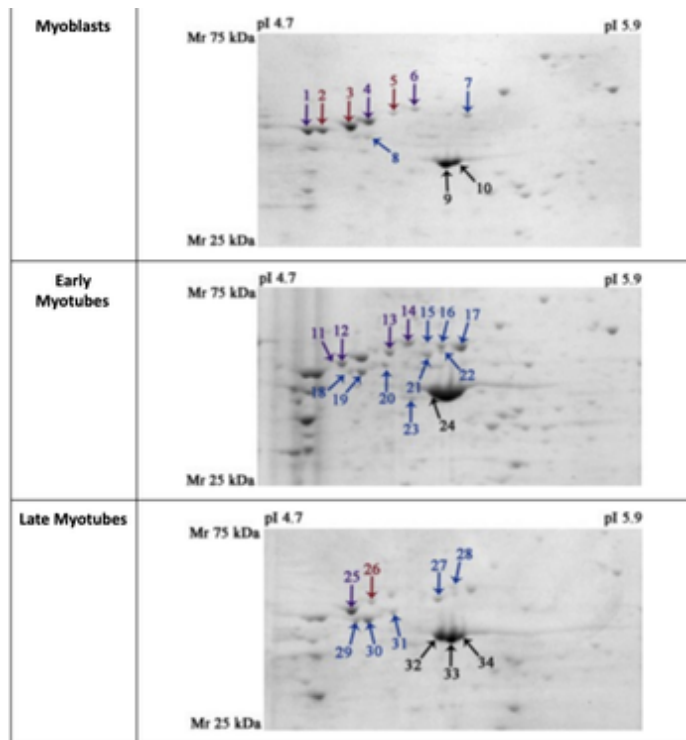
Title of Abstract/Research

Desmin and Vimentin During Myogenesis in C2C12 Cells: A Proteomics Study

dimensional scaffolding around the contractile subunit, the sarcomere. Vimentin (53,688 Da, (https://www.uniprot.org/)) is present in mesenchymal cells and helps maintain the integrity of the cells to avoid and mitigate damage. Using C2C12 cells (Saxel and Yaffee, 1977), we studied the changes in the quantitative expression of desmin and vimentin during myogenesis in vitro. Furthermore, using quantitative immunoblotting and proteomic analyses we uncovered cross-reactivity with vimentin in two "desmin-specific" antibodies.

C2C12 cells were grown in Dulbecco's modified Eagle's medium and harvested at three myogenic stages: myoblasts (Day 0), early myotubes (Day 4), and late myotubes (Day 9). Protein concentrations were estimated using a modified Lowry Assay (Lowry et al., 1951) and these extracts were analyzed by narrow range 2D gel electrophoresis experiments. The stained gel spots were excised and analyzed by high-pressure liquid chromatography-coupled mass spectrometry (LC/MS) for protein identifications. The LC/MS data were validated by immunoblot analysis. The results indicated that the desmin concentration increased during myogenesis (Figure 1a). For vimentin, there was an increase during the early stages (myoblast to early myotube) and a decrease to the last stage (late myotube) (Figure 1b). Finally, our immunoblots confirm the "desmin-specific" antibodies cross-react with vimentin (Figure 2, purple arrows).

Figure 1. a) Desmin (n= 5; for each stage) protein abundance (pixel intensity), normalized to total stain on the gel, b) Vimentin (n= 5; for each stage) protein abundance (pixel intensity), normalized to total stain on the gel, * = significant at $p < 0.05$.

Figure 2. Two-dimensional gels of myoblasts, early myotubes, late myotubes (7 cm pH 4.7-5.9 IPG strip and 11 cm 10.5%-14% Tris-HCl SDS polyacrylamide gel). The Mr range is approximately 25-75 kDa. The numbered spots are the results of the (LC/MS) protein identifications. Spots labeled with blue arrows and numbers contain desmin. Spots labeled with red arrows and numbers contain vimentin. Spots labeled with purple arrows and numbers contain both vimentin and desmin.

These data for this work were generated by Aunaly Palmer and Katharine von Hermann.

SURF Abstract Submission & Post Program Survey 2020

Name

Alana Brown

Year of Graduation

2021

SURF Advisor

Torquato,Samantha, Biological Sciences

SURF Field of Study

Biological Sciences

Title of Abstract/Research   Genomic Analysis of Sea Turtle Parasites

Please type your abstract below.

Nematodes and leeches are two common types of parasites that are known to infect two species of sea turtles, Chelonia mydas and Caretta caretta, both of which are found in the Mediterranean Sea. During my ten weeks of Remote SURF, I worked to identify eight parasite samples for a collaborator from four sea turtle rescue centers along the Adriatic coast. Usually, our laboratory uses molecular biology techniques (such as PCR and Sanger sequencing) in order to identify parasitic species; however, due to the pandemic, accomplishing benchwork was not possible this summer. The laboratory had previously whole-genome sequenced each of the eight parasite samples using the Illumina MiSeq. Therefore, the genomes had to be bioinformatically analyzed for three Genes of Interest: ITS2, SSU, and COX1. These genes were chosen because they are referred to in the literature for evolutionary analyses and the identification of specific species. First, the NCBI database was used to find potential marine parasite sequences for the three Genes of Interest. Then, the eight samples' sequencing reads were de novo assembled using DNASTAR NGen in order to create each sample's genome. I performed a computer-based nBLAST analysis between each sample's de novo assembled genome and each of the Genes of Interest. Once the COX1, SSU, and ITS2 gene sequences were discovered in a given sample contig, an alignment program, SeaView, was used to ultimately determine the best nucleotide match between the reference gene sequences and sample contig sequences. An online BLASTn and SRA-BLASTn was performed with the identified gene sequences in order to determine each sample's most likely species and to confirm that the samples were not contaminated by turtle DNA, respectively. We ultimately identified the eight samples as one of the following: a marine, free-living ribbon worm (Emplectonema gracile), a known sea turtle-infecting nematode (Sulcascaris sulcata), and a marine leech (Ozobranchus margoi).

In the last few weeks of my Remote SURF experience, I also contributed to a marine mammal parasite research project. This project aims to design a non-invasive quantitative real-time PCR (qRT-PCR) diagnostic assay for the harbor seal lungworm, Otostrongylus circumlitus. I designed possible primers and probe sets, which specifically target repetitive sequences within the O. circumlitus genome. In the future, members of the laboratory will need to run qRT-PCR assays with the newly designed primers and probes in order to determine which assay is the most sensitive and specific.

SURF Abstract Submission & Post Program Survey 2020

Name   Alina Barylsky;

Year of Graduation   2020

SURF Advisor   Jackson, Benita; Psychology

SURF Field of Study   Psychology

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

Benita Jackson, Olivia Pomeroy, Stephaney Perez, Uzma Malik, Emma Westgate, Alina A. I. Barylsky, Egypt Ballet, Abby Smith, & Isabel Schroedel

Title of Abstract/Research

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SURF Abstract Submission & Post Program Survey 2020

Name   Aminah Williams

Year of Graduation   2021

SURF Advisor   Katz, Laura; Biological Sciences

                                      Biology
SURF Field of Study

Title of Abstract/Research   Using "Single Cell Omics" to Determine the Genomes of
                                     Understudied Foraminifera

Please type your abstract below.

My goal for SURF 2020 was to understand the methods used to study the genome of understudied single-celled organisms such as ciliates and foraminifera (forams). Forams and ciliates are protists that are apart of the SAR clade. Forams are apart of Rhizaria, while ciliates belong to Alveolates (Pawlowski, 2017). Unlike Ciliates, Forams are more largely understudied and have a lack of genomic information available. Single cell-omics, a combination of genomics and transcriptomics, can be used to attempt to determine the genome structure of understudied organisms. In order to gain further understanding of how to pursue such methods, I spent the summer learning how to use the Python programming language, reading papers related to genomes and genome assembly of single-celled organisms, and brainstormed potential methods that could be used on understudied foraminifera.

Overall, I was focused on learning new bioinformatic skills and applying them to foram bioinformatic data that I have already obtained from prior projects. For example, Cibicides is a foram that lives epizoically on a wide range of organisms (DeLaca et al, 1987). There are extensive studies about the morphology of this organism, but scarce information about the Cibicides genome. Genomic studies obtained by our lab in the past proved that sequences we obtained were poor quality. The research I conducted this summer on organisms that are closely related to Cibicides helped me brainstorm ideas for obtaining better quality sequences in the future.

SURF Abstract Submission & Post Program Survey 2020

Name   Anh Nguyen

Year of Graduation   2022

SURF Advisor   An Wong,Tian; Mathematics and Statistics

SURF Field of Study   Mathematics

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

Title of Abstract/Research   Elliptic Dedekind Sums for Discrete Subgroups $PSL(2, \mathbb C)$

Please type your abstract below.

Dedekind sums are classical objects in number theory associated to $PSL(2,\Z)$. They arise from the transformation law of the Dedekind η-function. In his paper, L. J. Goldstein defined a generalization of the Dedekind sums to discrete subgroups of $PSL(2,\R)$. On the other hand, elliptic Dedekind sums are analogues of Dedekind sums for $PSL(2, \mathcal O_K)$, where $\mathcal O_K$ is the ring of integers of an imaginary quadratic field. In this talk, we present a generalization of these Dedekind sums to discrete subgroups Γ of $PSL(2,\C)$.

From the Fourier expansion of the Eisenstein series $E_A(P,s)$ at a cusp ζ for Γ by Elstrodt, Grunewald and Mennicke, we obtain an analogue of Kronecker's first limit formula following the work of Goldstein. The limit formula will lead to an analogue of the Dedekind η-function. From its transformation formula, we define a new analogue of the Dedekind sums attached to Γ and ζ. This should have applications to computations of modular forms over imaginary quadratic fields.

SURF Abstract Submission & Post Program Survey 2020

Name   Anna Pearson

Year of Graduation   2021

SURF Advisor   Loveless, Jack; Geosciences

SURF Field of Study   Geosciences

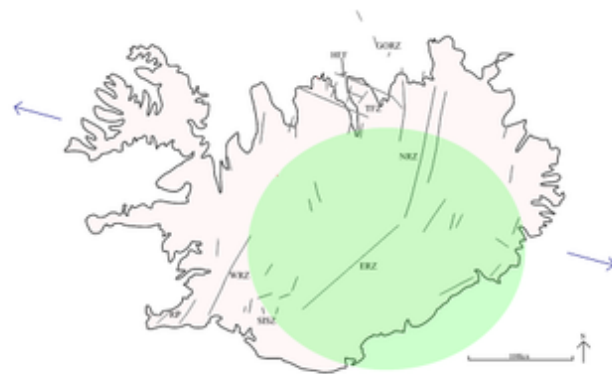**Upload image(s) in .png format; 1,100 MB max size each**

Fig. Map of Iceland, with fault map shown in black, the approximate footprint of the hotspot shaded in green, and the axis of rifting shown as blue arrows. Major seismic zones are identified as follows, clockwise from the top: HFF (Húsavík-Flatey Fault), OORZ (Grímsey Oblique Rift Zone), TFZ (Tjörnes Fracture Zone), NRZ (Northern Rift Zone), ERZ (Eastern Rift Zone), SISZ (South Iceland Seismic Zone), WRZ (Western Rift Zone), and RP (Reykjanes Peninsula).

Title of Abstract/Research

Evaluating Strike-Slip Faulting Parallel to the Icelandic Plate Boundary Using Fault Slip Measurements, Crustal Seismicity, and Boundary Element Models

Please type your abstract below.

Most faults in Iceland strike roughly parallel to the plate boundary, which would be expected to lead to primarily normal faulting. However, several studies have found a significant component of plate boundary-parallel, strike-slip faulting in Iceland and proposed varying explanations. To evaluate these different mechanisms, we model fault slip and crustal stress patterns in Iceland arising from a variety of processes, focusing here on mechanical fault-hotspot interactions. We use a boundary element model of the Icelandic tectonic system that includes a spherical hotspot, stress derived from geodetic strain patterns that reflect rifting, and a network of faults, as shown in the attached figure, along with several important seismic regions marked. On the fault network, we estimate the fault slip required to relieve traction imposed by the hotspot and remote stress. We compare the modeled fault kinematics to moment tensors derived from published fault slip measurements and principal stresses from earthquake focal mechanisms and slip data. We note similarity between the model-predicted slip and fault slip measurements, with both identifying significant components of normal and primarily dextral strike-slip faulting. This occurs in a reference model using an applied rifting angle consistent with the Nuvel-1A value of 105°, and supplementary influence from the hotspot, with a stronger hotspot contribution causing sinistral slip in northwest Iceland. The preliminary results compared to principal stresses, using the same model parameters, suggest agreement with $\sigma 3$, with an average trend of 102° as compared to 110°, and $\sigma 1/\sigma 2$ results that either also agree or appear to be permuted. Models based on a GPS velocity field, in which the hotspot is not explicitly modeled but is considered to impact the velocity field, also agree well with the reference model, except for a switch from dextral to sinistral slip on the Reykjanes Peninsula and the Húsavík-Flatey Fault. Our results suggest that current deformation of Iceland, tracked by geodetic data, is consistent with fault kinematics inferred from both recent seismicity and longer-term records of geologic fault slip. When synthesized in our models, we interpret that these data illustrate that a significant portion of strike-slip faulting in Iceland is likely driven by tectonic rifting, hotspot impacts, and mechanical interactions across the fault network.

SURF Abstract Submission & Post Program Survey 2020

Name   Annah N Mutaya

Year of Graduation
                                            2023

SURF Advisor   Rubin, Aaron; Engineering

                                            Geo-technical Engineering
SURF Field of Study

Title of Abstract/Research   Analysis of minimum and maximum density tests on ballast/fouling sample.

Please type your abstract below.

For the design of railway track structures, accurate geo-technical properties of the ballast layer are required. Ballast refers to the crushed limestone or other type of rock that forms the track bed upon which railroad ties are laid. Because this layer is responsible for bearing the load of the rail track, it is of prime importance that it be as strong as geo-technically possible. For this reason, the ballast is placed as compact as practical when first constructing a new railway. However, the ballast material degrades overtime mainly due to cyclic loading and vibration, temperature and moisture fluctuation, and impact load on ballast due to severe braking. This then results in an uneven distribution of the ballast particle size as it breaks down into smaller particles known as fouling. It is therefore important to geo-technical engineers to know how the strength of the ballast material changes with a change in the gradation size of the ballast material. A careful study of the relative densities of the different ballast/fouling sizes can provide an insight into how the geo-technical properties of the ballast layer varies with size. Over the summer, I attempted to characterize the behavior of the minimum and maximum densities of a ballast/fouling sample from the UMass-Amherst area. Prior to the tests, the samples were kept at room temperature and away from any moisture. The tests were done outside in the opening and in accordance with the ASTM D4254 standard procedure Method B for the minimum densities. The maximum density tests were conducted manually using a manual standard soil compaction hammer. 10 minimum and 10 maximum density tests were first carried out on the hand-separated fouling. Then 10 maximum and minimum density tests were performed on each of the fouling obtained from sieve numbers 200, 100, 60, 40, 20, 10 and 4. Mass of the samples and volume of standard proctor cylinder was used to calculate the relative minimum and maximum densities. . A 2inch diameter by 18-inch height standard compaction hammer was used to provide 25 blows per each layer for 5 layers to give the maximum density values. The obtained mass of the fouling and the standard volume of the cylinder was used to calculate the density of each fouling sample. A decrease in the minimum densities was observed as the particle size of the fouling got larger. There was slight discontinuity between the sieve no.40 and the no.20. The maximum density values generally increased with an increase in the particle size of the fouling, again with a discontinuity between the sieve no.100 and the no.60. The experiment could not attest for the reason of the discontinuities.

REFERENCES
    D 4254 – 16 Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density, ASTM. Published September 2016.
    An Introduction to Geo-technical Engineering, Holtz, R.D and Kovacs, W.D. Published 1981.
    Particle size conversion table, sigmaaldrich.com/chemistry/stockroom-reagents/learning-center/technical-library/particle-size-conversion.html

SURF Abstract Submission & Post Program Survey 2020

Name   Annie Dobroth

Year of Graduation   2021

SURF Advisor   Beery, Annaliese

SURF Field of Study   Neuroscience

Title of Abstract/Research

Please type your abstract below.

For my SURF project, I worked in the lab of Smith Professor Annaliese Beery to explore the feasibility of using machine learning tools to create an automated system for analyzing Partner Preference Tests, a tool used to study social behavior of voles.

The Beery Lab researches social behavior, primarily through observing and manipulating the neurobiology of prairie voles (Microtus ochrogaster). These voles are unusual rodents because they form strong monogamous bonds with their mates. They are useful models in the study of human social neuroscience because their interactions with other animals mirror human behavior more closely than those of rats or mice. In addition, human brain structures and chemicals relating to social interactions and behavior are also more similar to voles than other species of rodent. Thus, the neuroscience of social interactions in prairie voles can be studied as a model for human behavior.

A common technique used to study voles is recording them during different tasks, and then watching these recordings at high speed to quantitatively score the behavior. This manual scoring process is time and labor intensive. The goal of my project was to explore how machine learning tools could be used to automatically score tests and so improve the amount of data that can be analyzed quickly and efficiently. I focused on a test called the Partner Preference Test (PPT) because it is commonly used and time consuming to score. Each PPT recording is at least 3 hours long, and a single research project has at least twenty PPTs. Even when watching on a quick speed setting, scoring the PPT is a time consuming and boring yet arduous task.

Most of my summer work involved researching and trying out available machine learning and deep learning tools to determine which would be most useful for Lab's specific needs. My proposed solution is to use a combination of pose estimation software, specifically DeepLabCut and Social Leap, and a behavioral analysis program called SIMBA in order to track the movements and behavior of each vole.

I plan to continue this project during the semester as a thesis project. I will create a program that will input a video of a PPT and automatically produce an analyzed test, cutting down on hours of manual labor. I hope this application can also pave the way for more machine learning applications to be used in the lab in the future.

SURF Abstract Submission & Post Program Survey 2020

Name   Ashley Fishbein;

Year of Graduation   2020

SURF Advisor   Bellemare, Jesse

SURF Field of Study   Biological Sciences,   Ecology

Title of Abstract/Research

No refuge: Decline of a northern forest herb, Clintonia borealis (Aiton) Raf. (Liliaceae), at multiple sites along a broad elevational gradient suggests impacts of recent climate change

Please type your abstract below.

Recent climate change has impacted the performance and distribution of species around the globe. In the Northeast U.S., declines and local extirpations of several northern plant species have been recorded. However, there have been few controlled, longitudinal studies documenting these impacts. We surveyed populations of the northern forest herb Clintonia borealis (Aiton) Raf. (Liliaceae) growing under different climatic conditions in permanent plots along an approximately 1000-m elevational gradient in western Massachusetts in 2010-11 and 2019. Plant performance was significantly positively correlated with elevation in 2010-11, with ramets at higher elevation being significantly larger and populations having a higher rate of flowering. We found that all populations declined in at least two measures of plant performance. Our results suggest changing climatic conditions may cause this common northern forest herb to decline and disappear from many locations in the near future, as has already been documented for rarer northern plant species in the area.

SURF Abstract Submission & Post Program Survey 2020

Name   Brittany Torres

Year of Graduation
                                    2022

SURF Advisor   Hayssen, Virginia; Biological Sciences

SURF Field of Study   Biology/Forensics

Title of Abstract/Research   Forensic Chemistry in Medical Examinations

Please type your abstract below.

This summer, as a SURF student, the focus of my research underwent a massive transformation in response to the murder of George Floyd. The original focus of my research, reproductive biology in mammals, evolved into a passion-fueled investigation of forensic chemistry in the context of medical examinations. This was motivated by the contradiction between private and federal reports detailing the cause of George Floyd's death. My research was transformed by these events into a project of relevance to my major, but with the largest goal of broadening the reach of Smith's Chemistry Department.

SURF Abstract Submission & Post Program Survey 2020

Name	Cassandra Gonzalez;
Year of Graduation	2021
SURF Advisor	Lello, Denise; Biological Sciences;
Secondary SURF Advisor	L.;David Smith
SURF Field of Study	Marine Science

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

Title of Abstract/Research   Coral Reef Ed-Ventures 2020

Please type your abstract below.

Summer 2020 was the twenty-first year of the Smith College collaboration with Hol Chan Marine Reserve on Ambergris Caye, Belize to create an environmental education and conservation experience for the children of San Pedro. The goals of Coral Reef Ed-Ventures are to conduct research on coastal ecosystems and communities and to offer an environmental education and conservation experience for the children of San Pedro Town on Ambergris Caye. Due to the Covid-19 Pandemic, the research focused on the educational aspect of creating lesson plans instead of researching the coral mounds at Mexico Rocks and mangroves propagules located in lagoons near the Grand Belizean Estates development as the students were remote. Five Smith students developed remote lesson plans for the two free camps they designed for children on the island, incorporating methods with Smith College professors and knowledge from prior camps.

The students worked closely with Shannon Audley, Professor of Education & Child Study, and had conversations with previous Coral-Ed Alumni who are currently involved in education to identify the best methods of remote learning. A variety of online resources were suggested to help deliver our lesson plans. Several suggestions were made as far as how to keep students engaged in a remote learning context. One of which was to make videos and include activities that will get students to explore their environment, as well as opportunities for students to communicate with one another virtually. Each lesson plan created went through a review process. Each of the five students created at least one lesson plan and identified the goals of that lesson. Then peer-reviewed one another's lessons and provided feedback. Following this stage of the process, students discussed their lesson plans as a group and then went on to adapt the plans to a Google Forms platform. The google forms were presented to the group through a zoom call once again to weed out all potential flaws. Once the extensive review process for each plan was complete, the lessons were made available online.

In summary, our research supported children's online learning experience providing them the opportunity to be exposed to environmental changes that are impacting their everyday life (e.g., plastics). This summer of Coral Reef Ed-Ventures was full of new experiences and learning opportunities that we hope to expand upon in the coming years.

SURF Abstract Submission & Post Program Survey 2020

Name   Catherine Park;

Year of Graduation   2023

SURF Advisor   Peckol, Paulette; Biological Sciences

SURF Field of Study   Marine Ecology

Please list co-authors of your abstract (if applicable)   Michaela Guy, Perryne Vega

Title of Abstract/Research   SURF Research During the COVID Pandemic: Effects of Climate Change and Environmental Racism on Coastal Communities

Please type your abstract below.

Due to COVID-19, Smith College was closed for the summer and students conducting SURF research needed to do so remotely. Our summer work included: 1) keeping a reflective journal that addressed questions and concerns that arose throughout the summer, 2) reading and discussing scholarly articles in the field of marine science on topics of habitat degradation and environmental justice. 3) designing and conducting short field studies as a group and individually, and 4) working independently in a growth/leadership area of our selection. We met for Zoom meetings twice per week to discuss our reflective journal response and scientific findings. Here, we detail some of our remote work.

While working remotely, we focused on marine policies and discussed the pandemic and social justice issues. Our research was guided by considering solutions to environmental and societal problems in marine communities. All of us maintained journals that chronicled our thoughts on these topics. Each entry reflected the growth of our opinions and understanding. Catalyzing this growth was the integration of social justice topics into our marine science literature (e.g., intersection between racism, classism, and the establishment of marine protected areas). We designed and conducted two observational studies. The first group study focused on the percentage of males vs females wearing masks. We analyzed the data as a team. We worked independently for the second field project, studying specific activities and behavior of selected animal species. We discussed these projects as a group, fine-tuning our methodology and analyses. This summer also included individual personal growth projects. RStudio coding was part of two personal projects with Catherine Park expanding her skills in data visualization and analysis of the life sciences, and Michaela Guy using it to supplement her reflections on social justice and the Black Lives Matter Movement. Perryne Vega's independent project explored COVID-19 effects on fisheries, specifically looking at marginalized groups and highlighting the downfalls of systems set in place to support minority groups.

Though we were unable to conduct field/lab studies in marine science, this SURF experience provided us with many skills relevant to the field. While we considered the pervasive environmental racism embedded in many policies at national and international levels, we studied successful policies and brainstormed ideas for greater equity and involvement of all stakeholders. Finally, our independent projects enabled us to explore more individualized areas of interest that have enriched our Smith learning experience.

SURF Abstract Submission & Post Program Survey 2020

Name   Catherine Spencer;
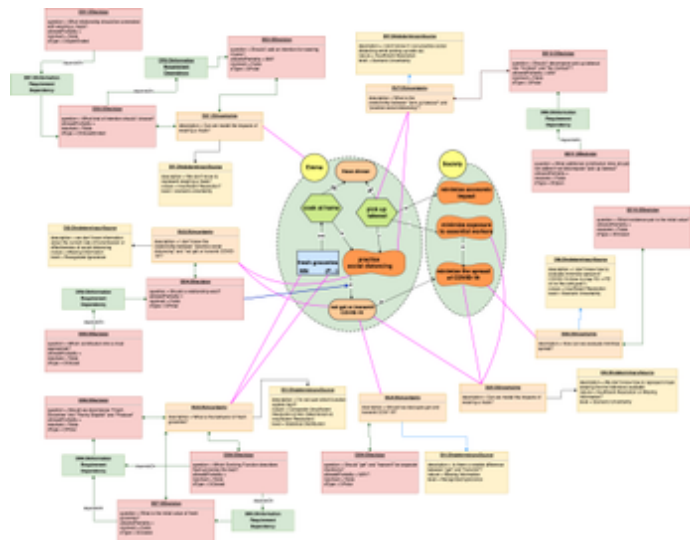
Year of Graduation   2022

SURF Advisor   Grubb, Alicia; Computer Science

SURF Field of Study   Computer Science

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

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

Title of Abstract/Research   Exploring Uncertainties in COVID-19 Modeling

Please type your abstract below.

Goal Modeling is used in early phases of projects to evaluate tradeoffs with stakeholders. These models consist of intentions, such as goals, tasks and resources, and are encapsulated in actors that represent stakeholders. These intentions are then connected with links, such as '++', '--', 'and', and 'or'. For example, [our attached figure] shows the actor Emma, who is a student deciding how to have dinner and has the goal of 'make dinner'.

In the spring of 2019, we observed the wide use of models to understand the evolving COVID-19 global pandemic. For example, Bayesian models were used to describe the spread of the virus. We aimed to understand how our goal modeling tools and analysis could be used to make tradeoff decisions in the context of this pandemic. Our SURF project focused on creating a case study of individual decisions in the early stages of the COVID-19 pandemic. Previous case studies were analyzed retroactively, and this crisis provides a unique opportunity to make relevant models and validate our technique as the pandemic progresses. We initially created a collection of goal models based on personas that reflected different stakeholder views of COVID-19. The personas varied in compliance with COVID-19 guidelines, and values, and were based on reactions to publicized models on the pandemic progression in Quebec, Canada.

The development of our case study enabled our collaboration with a team from the Geodes lab at the Université de Montréal to explore modeling and resolving uncertainties in requirements.
As a proof of concept, we focused on the Emma model (see figure) and evaluated the inherent uncertainties in our model using DRUIDE (Design and Requirements Uncertainty Integrated Development

Environment). Specifically, we describe uncertainty about modeling and what we could and could not represent in this model, as opposed to any uncertainty an actor may have about their decisions. For example, a modeler may ask, "should we separate contracting and transmitting COVID-19?", or "how can we model Emma's use of a mask?". We then localize these questions in our model. For example, we can add a decision to the model giving the modeler the option of adding a resource labeled "mask". DRUIDE gave us a formal language (via a metamodel) to identify modeling uncertainty and localize it on the model, which allows us to concretize the uncertainty into decisions which can be acted on.

Our team then connected our DRUIDE enabled goal model of Emma with a Bayesian model that describes the spread of COVID-19, allowing us to understand how decisions in one model impacts the other. We also found similar design uncertainties across models. Finally, we worked to implement these features in MMINT, an Eclipse-based mega modeling extension for Interactive Model Management.

SURF Abstract Submission & Post Program Survey 2020

Name   Chenhui Jia;

Year of Graduation   2022

SURF Advisor   Kinnaird, Katherine; Computer Science

SURF Field of Study   Computer Science

Please list co-authors of your abstract (if applicable)   Sasha Yeutseyeva, Katherine M. Kinnaird

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

```
example.py
| --> create_sdm
| --> find_initial_repeats
| --> find_complete_list
|       | --> add_annoations
|       | --> find_add_erows
|       | --> find_add_srows
|       | --> find_add_mrows
| -->remove_overlaps
|       | --> separate_anno_markers
|       | --> create_anno_rows
|       | --> create_anno_remove_overlaps
|               | --> add_annotations
|               | --> reconstruct_full_block
| --> hierarchical_structure
|       | --> breakup_overlaps_by_intersect
|       |       | --> check_overlaps
|       |       | --> reconstruct_full_block
|       |       | -->compare_and_cut
|       |       |       | --> merge_based_on_length
|       |       |               | --> merge_rows
|       |       |                       | --> reconstruct_full_block
|       |       | --> merge_based_on_length
|       |               | --> merge_rows
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|       | --> reconstruct_full_block
|       | --> find_initial_repeats
|       | --> find_complete_list_anno_only
|       |       | -->add_annoations
|       | --> find_all_repeats
|       |       | --> find_initial_repeats
|       | --> remove_overlaps
|               | -->separate_anno_markers
|               | --> create_anno_rows
|               | --> create_anno_remove_overlaps
|                       | --> add_annotations
|                       | --> reconstruct_full_block
```

Title of Abstract/Research   ah: an Aligned Hierarchies Package

Please type your abstract below.

Music often has repeated elements that build on each other, creating hierarchies. Extracting these repetitions and their relationships to each other is the goal of the python package AH. This package creates aligned-hierarchies of music based data streams through finding and encoding repeated structures, and is based on Katherine M. Kinnaird's thesis Aligned Hierarchies for Sequential Data and the accompanying MATLAB code. This summer, we completed, improved on, and successfully debugged the package started last summer, by cross-referencing the desired output of the package with the output of the MATLAB code. Additionally, we created Jupyter notebook files that act as a guide through the package, including summarizing each individual function. There is a separate notebook file for each module, as well as an overarching file highlighting the code from start to finish. Moreover, we also created test files for each module to make sure the functions work as we desired. Future steps for this project include writing and submitting a paper outlining this code to the Journal of Open Source Software as well as further developing the package to include aligned sub-hierarchies, which are derivatives of aligned hierarchies and a structure-based approach to the cover song task.

SURF Abstract Submission & Post Program Survey 2020

Name

Dahlia Rodriguez;

Year of Graduation

2022

SURF Advisor

Barresi, Michael; Biological Sciences

Secondary SURF Advisor

Narendra Pathak

SURF Field of Study

Neuroscience

Title of Abstract/Research   Meteorin and Meteorin-likes Role in Embryonic Development

Please type your abstract below.

Signaling proteins are a vital aspect of developmental biology, they are responsible for cell differentiation which helps build complex organisms from totipotent stem cells through the regulation of gene expression leading to the specialization of cells. I had the opportunity to learn about meteorin, a glial cell differentiation factor that functions as an extracellular signaling protein. I was able to read current literature and previous studies that were conducted in the Barresi lab focusing on metorin and meteorin-like's role in the development. I learned about signaling pathways that may have interplay with meteorin such as WNT/FGF opposing gradients which help determine the mid-hind brain boundary, the Jak/Stat3 pathway which is responsible for the expression of GFAP, and the nodal pathway which plays a role in proximodistal and anterior-posterior axes formation as well as mesendoderm specification. I also participated in the Society for Developmental Biology Virtual Conference where I learned about many different projects currently being pursued in the field of developmental biology as well as influential presentations on a wide range of topics from light-sheet microscopy to tips on language use when writing and presenting. The conference also allowed me to see current techniques being used in developmental biology research including staphylococcus aureus Cas9 nuclease, single-cell RNA sequencing, and the use of new model organisms such as Jerboa and Anolis lizards. We had training on the use of CRISPR-Cas9 for genome editing, using bioinformatics to find appropriate targets for promoterless gene knockouts, morpholinos, concept map development, genetic compensation mechanisms, forward and reverse genetic methods of studying genotype/phenotype relationships and learning to use various online databases to support our research. I created a concept map outlining papers that were related to my project in an effort to identify new experiments we could do in the future and highlight work that has already been done. During my work, this summer I decided to pursue an honors project this year to further elucidate meteorin and meteorin-likes functions and mechanisms in development through the creation of a promoterless knockout. I plan to aid in the development of a promoterless mutant strain by deleting large genomic segments within the promoter regions of these genes using CRISPR-Cas9. The analysis of meteorin and its paralog, meteorin-like is already underway my hope is that this work will help us to further characterize meteorin and meteorin-likes role by characterizing neuro-glial phenotypes in these mutants.

SURF Abstract Submission & Post Program Survey 2020

Name   Egypt Ballet

Year of Graduation   2023

SURF Advisor   Jackson, Benita; Psychology

SURF Field of Study   Psychology

Please list co-authors of your abstract (if applicable) Benita Jackson, Olivia Pomeroy, Stephaney Perez, Uzma Malik, Emma Westgate, Alina A. I. Barylsky, Abby Smith, & Isabel Schroedel

Title of Abstract/Research Translating Psychological Science to the Public: Re-framing "Rest" As Central to Social Change

Please type your abstract below.

The first half of 2020 was marked by a global pandemic and social and political upheaval. With the additional backdrop of the climate crisis, there is much need for coalition building to address the factors that divide social groups. And yet, it remains unclear the most effective and efficient ways to resource, grow, and connect needed social movements when there are so many possible actions to take. A first response might be to "do more!" But, following from research in the varied domains of health, cognitive function, productivity, organizational behavior, and sociology, we see that planned fallow periods are perhaps counter-intuitively what best cultivate physical, mental, behavioral, and societal well-being. Our team culled and vetted more than 100 audio talks, and for each talk, identified key persuasive passages and multiple accompanying academic research articles in a project to "give psychology away." Specifically, we gathered the raw materials needed to create an outward facing translational project of science for the greater public promoting the notion of "resting to rise." Erica Chenoweth, human rights and international affairs expert, has data in support of the "3.5% rule"- that it takes only a small portion of a population facing in the same direction to make non-violent change of its government. Our goals are, via message framing and repetition, to persuade listeners that the concept and practice of rest will not only confer benefits for their personal and collective well-being, but must be central to them. The work our team completed this summer builds a key foundation toward these ends.

SURF Abstract Submission & Post Program Survey 2020

Name   Eleni Partakki;

Year of Graduation   2022

SURF Advisor   Crouser, Jordan; Computer Science

SURF Field of Study   Computer Science

Title of Abstract/Research   Smith College HCV Lab: Analysis on 2019 LAS

Please type your abstract below.

The research this summer mainly consisted of an analysis of data from investigating the complementary nature of human and machine computation and systems that make use of the human visual system, as well as our capacity to understand and reason about complex data. We explored how participants navigated through the dataset over the course of their analyses. The three focus points were the impact of "clicking down" behavior based on initial ordering, revisiting patterns, and marking of relevancy.

Using the EuroVis Short Paper, which found that some participants were more likely to be influenced by the initial ordering of the returned query results when filters were cleared, we were able to show that a particular ordering could ultimately influence which parts of the data subjects explored later.

Based on a specific ordering, there is an impact on when a participant revisited relevant data and at which point in their analysis that was done. We found that when participants realized the relevancy of an article, resume, or email, they would tend to spend more time reading, and that would also be their first trigger to take a note that was relevant to their search. In addition, after coming across relevant content, their use of the search feature had increased. We found that revisits and the total number of actions are correlated. The more actions a participant commits, the more likely they are to make revisits. For each action, there are likely 0.4 more revisits and for every additional action, the odds of revisit increased by 1.6 times, on average. The revisit behavior seemed to not be affected by personality traits but rather by duration and relevance. We had also noticed that participants who tend to have more revisits, were also more likely to view a variety of unique items.

Overall, it seemed that initial ordering impacted how quickly a participant would explore relevant information and their effective use of other resources such as the search and note options.

SURF Abstract Submission & Post Program Survey 2020

Name   Ellen Dong

Year of Graduation   2022

SURF Advisor   Crouser, Jordan; Computer Science

SURF Field of Study   Computer Science

Title of Abstract/Research   LAS Data Analysis for TVCG

Please type your abstract below.

Throughout the summer, we have continued the exploration of understanding how individual differences modulated expert behavior in complex analysis tasks. Within the case study, 32 Navy Reservists of different ages, ethnicities, gender, and education, comfort with computers, and locus of control were given a short introduction that outlined relevant information regarding a kidnapping that involved some employees from a company. They were asked to uncover the organizational structure of the group responsible for the kidnapping by analyzing different data sources, such as email headers, resumes, short biographies of the employees, employee records, and historical reports.

I was tasked with the literature review, the characterization of the participants, and started to answer the question "why" in how the participants behaved. Throughout the research, I found how locus of control plays a part in our everyday behavior, and how other factors, such as the Big Five Personality Traits, modeling of testing, or Spatial Awareness, are affected by locus of control and how they affect locus of control.
To characterize our participants, I mainly compared the participants with the participants in other research articles and noted the differences within our participants. Similarly, I also summarized all of the testing models for different psychological factors and participants' response to the data visualizations within the research articles to compare the different methods to our research and see if they could provide some context with our results. Within a survey of all the research related to Data Visualizations and Psychological factors, such as locus of control, I also helped with providing a psychological context to the information. We also organized the relevance data (reading articles given within the task and then marking whether the current article was relevant to the kidnapping and whether the article was an "original" article) in order to gather information about their tracking behavior and try to gain a greater understanding of the participants' thought process.

SURF Abstract Submission & Post Program Survey 2020

Name   Elora Greiner

Year of Graduation

                                           2021

SURF Advisor   Barresi, Michael; Biological Sciences

Secondary SURF Advisor   Naren Pathak

SURF Field of Study   Developmental Biology

Abstract of Research Results

Title of Abstract/Research   Visualizing bioelectric patterns and their influence on axis determination in Danio rerio

Please type your abstract below.

During development, repair, and growth throughout an organism's life, intercellular communication is vital to keeping these processes coordinated across space and time. One hypothesized way of controlling this coordination is the pattern resting transmembrane voltage in cells, called "bioelectrics." The Barresi Lab started our work in this topic by using dyes, but as the embryos age, the cells differentiate and become variably permeable. Our new approach is to create a transgenic line of zebrafish that stably expresses a fluorescent Genetically Encoded Voltage Indicator (GEVI) in response to each cell's resting potential. By having the voltage reporter embedded in the genome, we can eliminate concerns over variable absorption and drug-dye interactions in treatments with altered polarity. This summer, I conducted literature reviews to learn more about the classes of GEVIs and their mechanisms, the types of ion channels and when those genes are expressed during zebrafish development, and planned my experiments for this fall. We will use this ion channel information to investigate the relationships between bioelectric patterns, ion channel distributions, and axis determination. By attending the Society for Developmental Biology National Conference and the Beckman Symposium online, I listened to lectures on current research topics and techniques, including cutting-edge microscopy. I also spent much of my time building computer skills that I will need for data analysis and presentations this year, including introductory Python and Adobe Photoshop. We were unable to create a transgenic line this summer because of wait times to receive materials, but by the last week of the summer, we had started collecting images of transiently expressed GEVIs. That data will be analyzed during the virtual fall semester as the foundation of my thesis project.

SURF Abstract Submission & Post Program Survey 2020

Name
Emily Blackwell

Year of Graduation
2022

SURF Advisor
Hayssen, Virginia; Biological Sciences

SURF Field of Study
Biological Sciences

Upload image(s) in .png format; 1,100 MB max size each
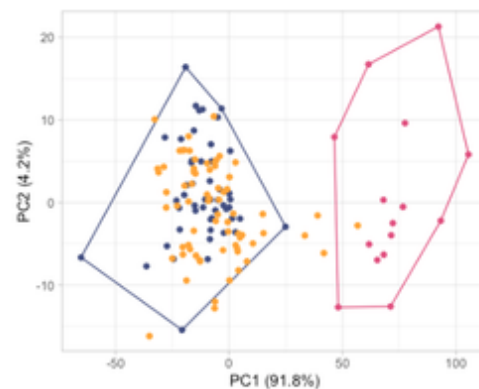
Figure 1: First and second principal components from an analysis of the species *Canis aureus* (Eurasia, blue), *Canis lupaster* s. str. (yellow), and *Canis lupus* (Asia, pink). Each point represents a single skull. Polygons are minimum convex hulls for the species *C. aureus* (left) and *C. lupus* (right), showing the overlap between *C. lupaster* s. str. and *C. aureus*. Percentages represent the percent of variance explained by the principal component.
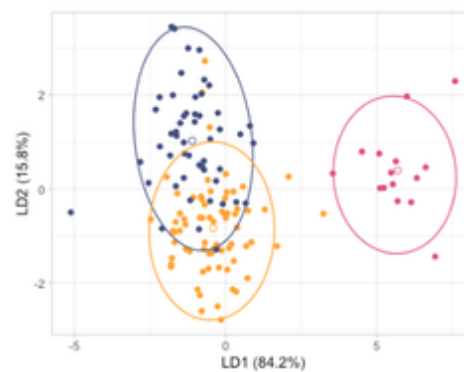
Figure 2: Linear discriminant analysis of the species *Canis aureus* (Eurasia, blue), *Canis lupaster* s. str. (yellow), and *Canis lupus* (Asia, pink). Each closed point represents a single skull, and each open point represents the centroid of the group. Ellipses represent the 95% confidence interval of each group. Percentages represent the percent of variance explained by the principal component.

Title of Abstract/Research	A jackal-like wolf: morphological evidence for taxonomy of Canis lupaster

Please type your abstract below.

The African golden wolf, Canis lupaster, is a newly defined species of canid found across northern and eastern Africa. In the past, this species was considered conspecific to the Eurasian golden jackal, Canis aureus. However, recent genetic evidence found that C. lupaster is more closely related to the grey wolf, Canis lupus, and is a species separate from both golden jackals and grey wolves (Viranta et al. 2017). Using a dataset with skull measurements of over 300 museum specimens of grey wolf, golden jackal,

African golden wolf, and three other African canid species, my work this summer investigated morphological evidence for African golden wolf phylogeny. I employed statistical techniques such as clustering analysis, principal component analysis, linear discriminant analysis, and multivariate analyses of variance to compare the skull morphology of the African golden wolf to the golden jackal and grey wolf. While the skull morphology of African golden wolves is similar to that of the golden jackal, the two differ significantly. I used the dataset to explore the possibility of C. lupaster encompassing multiple taxa, including sympatric golden jackals and hybrids with other sympatric canids. I also identified specimens within the dataset that are misidentified in their museum records. This misidentification has implications for other researchers using the same specimens. While the canid taxonomy project was my main priority as a SURF student, I also did some work in service of the American Society of Mammalogists. This included compiling documents detailing committee, editorial, and officers' society service to recognize active members and assisting in editing articles submitted to the Journal of Mammalogy as part of its "buddy system" for international authors. My work this summer allowed me to develop my research skills beyond what is possible during the school year, and I am excited to continue to develop the canid taxonomy project in the coming months.

References:
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SURF Abstract Submission & Post Program Survey 2020

Name   Emma Westgate

Year of Graduation   2021

SURF Advisor   Jackson, Benita; Psychology

SURF Field of Study   Psychology

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

Benita Jackson, Olivia Pomeroy, Stephaney Perez, Uzma Malik, Emma Westgate, Alina A. I. Barylsky, Egypt Ballet, Abby Smith, & Isabel Schroedel

Title of Abstract/Research

Translating Psychological Science to the Public: Re-framing "Rest" As Central to Social Change

Please type your abstract below.

The first half of 2020 was marked by a global pandemic and social and political upheaval. With the additional backdrop of the climate crisis, there is much need for coalition building to address the factors that divide social groups. And yet, it remains unclear the most effective and efficient ways to resource, grow, and connect needed social movements when there are so many possible actions to take. A first response might be to "do more!" But, following from research in the varied domains of health, cognitive function, productivity, organizational behavior, and sociology, we see that planned fallow periods are perhaps counter-intuitively what best cultivate physical, mental, behavioral, and societal well-being. Our team culled and vetted more than 100 audio talks, and for each talk, identified key persuasive passages and multiple accompanying academic research articles in a project to "give psychology away." Specifically, we gathered the raw materials needed to create an outward facing translational project of science for the greater public promoting the notion of "resting to rise." Erica Chenoweth, human rights and international affairs expert, has data in support of the "3.5% rule"- that it takes only a small portion of a population facing in the same direction to make non-violent change of its government. Our goals are, via message framing and repetition, to persuade listeners that the concept and practice of rest will not only confer benefits for their personal and collective well-being, but must be central to them. The work our team completed this summer builds a key foundation toward these ends.

SURF Abstract Submission & Post Program Survey 2020

Name

Estelle Yim

Year of Graduation

2021

SURF Advisor

de Villiers, Jill; Psychology

SURF Field of Study

Linguistics

Title of Abstract/Research   Referential Opacity / Pronoun Processing in Bilingual Speakers

Please type your abstract below.

Referential Opacity:

How do children monitor the truth of someone else's beliefs and knowledge of identities? This project aims to integrate the linguistic effects of referential opacity with the cognitive processes of False Belief Reasoning (FBR) and Theory of Mind. Referential Opacity for the purposes of this study refers to the ambiguity in whether a noun is used to refer to a specific person in the world or is used simply as a description of something. FBR refers to the ability to reason that another person's beliefs can differ from reality while Theory of Mind refers simply to how we understand the knowledge held by another person's mind. In an online study testing children (aged 4-7) and their understanding of characters' knowledge, questions were designed with the intention of identifying how referential opacity affects the children's abilities to succeed in FBR and in Theory of Mind.

Pronoun Processing in Bilingual Speakers:

Linguistic relativity refers to the principle claiming that the structure of a language affects its speakers' world view or cognition and that people's perceptions are relative to their spoken language. Following the principle that the structure of a language affects a speaker's cognition, this project aimed to isolate the cognition and comprehension of English pronouns in bilingual speakers of Korean and English, particularly those who are native speakers of Korean and non-native speakers of English. The primary cross-linguistic variations between Korean and English that are of interest are the pro-drop feature in Korean, the discourse-driven nature of reference in Korean, and the relatively weak and genderless system of pronouns in Korean, which are all features that are in direct opposition to characteristics of English. It has already been empirically observed that bilingual speakers of languages lacking in the pro-drop feature (Spanish, Chinese) also lack sensitivity to both the grammatical function and semantic meanings of pronouns in English; this project aimed to provide evidence for the same in Korean-English speakers. Modeled after other experiments that study English pronouns, a self-paced reading test paradigm was designed for participants to complete by completely online means. With the conclusion of data collection of around 100 participants (75 Korean-English bilingual speakers and 25 native English speakers), the data will be coded for reaction times as well as for grammaticality judgments that already show expected results. This study will be the foundation for an honors thesis project in Linguistics to be completed by Spring 2021.

SURF Abstract Submission & Post Program Survey 2020

Name   Genesis Canizales

Year of Graduation   2022

SURF Advisor   Smith, L. David; Biological Sciences

Secondary SURF Advisor   Denise Lello

SURF Field of Study   Environmental Science and Policy

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

Title of Abstract/Research   Coral Reef Ed-Ventures Summer 2020

Please type your abstract below.

Summer 2020 was the twenty-first year of the Smith College collaboration with Hol Chan Marine Reserve on Ambergris Caye, Belize to create an environmental education and conservation experience for the children of San Pedro. The goals of Coral Reef Ed-Ventures are to conduct research on coastal ecosystems and communities and to offer an environmental education and conservation experience for the children of San Pedro Town on Ambergris Caye. Due to the Covid-19 Pandemic, the research focused on the educational aspect of creating lesson plans instead of researching the coral mounds at Mexico Rocks and mangroves propagules located in lagoons near the Grand Belizean Estates development as the students were remote. Five Smith students developed remote lesson plans for the two free camps they designed for children on the island, incorporating methods with Smith College professors and knowledge from prior camps.

The students worked closely with Shannon Audley, Professor of Education & Child Study, and had conversations with previous Coral-Ed Alumni who are currently involved in education to identify the best methods of remote learning. A variety of online resources were suggested to help deliver our lesson plans. Several suggestions were made as far as how to keep students engaged in a remote learning context. One of which was to make videos and include activities that will get students to explore their environment, as well as opportunities for students to communicate with one another virtually. Each lesson plan created went through a review process. Each of the five students created at least one lesson plan and identified the goals of that lesson. Then peer-reviewed one another's lessons and provided feedback. Following this stage of the process, students discussed their lesson plans as a group and then went on to adapt the plans to a Google Forms platform. The google forms were presented to the group through a zoom call once again to weed out all potential flaws. Once the extensive review process for each plan was complete, the lessons were made available online.

In summary, our research supported children's online learning experience providing them the opportunity to be exposed to environmental changes that are impacting their everyday life (e.g., plastics). This summer of Coral Reef Ed-Ventures was full of new experiences and learning opportunities that we hope to expand upon in the coming years.

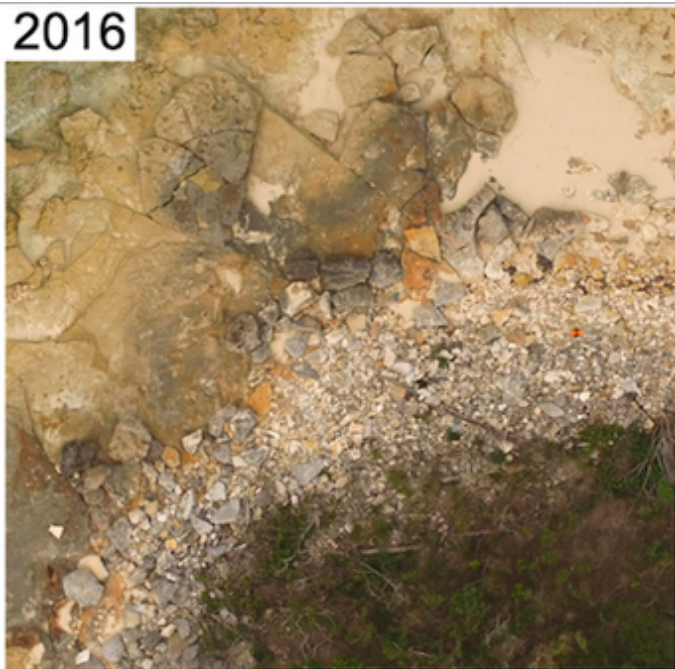# SURF Abstract Submission & Post Program Survey 2020

Name   Georgia Pharris

Year of Graduation   2022

SURF Advisor   Glumac, Bosiljka; Geosciences

SURF Field of Study   Geosciences

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

Kristine Lu '21 and Raissa Mugabekazi '21

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

Title of Abstract/Research

Impact of storms, sea-level fluctuations and climate changes on modern and Pleistocene environments of San Salvador

Please type your abstract below.

Using samples and data collected during the GEO 334 Carbonate Sedimentology January 2020 trip to San Salvador Island, Bahamas, and the following Spring 2020 course, we undertook two remote research projects this summer: 1) analysis of a core through a Pleistocene coral reef; and 2) evaluation of the impact of storms on two coastal sites on San Salvador. The first project focused on carbonate deposits from a 34 m deep core formed during the last interglacial period, ~125,000 years ago, when sea level was ~6 meters higher than present. These deposits provide important insights into the makeup and health of coral reefs in times of warm climate and high sea levels. Our research aims at documenting the distribution and impact of thick algal and microbial encrusters on corals within this fossil reef. Such encrusters can fill pore space in the reefal framework, altering porosity and permeability of these rocks and modifying their fluid storing and transporting properties. We investigated selected core samples using a variety of methods. Last spring we collected GeoTek density measurements along with iTrax core scanner radiographs and X-ray fluorescence (XRF) elemental data at the University of Massachusetts, Amherst. We also sent samples to the Special Core Analysis Laboratory in Texas for permeability, porosity and grain density measurements and CT scanning. During the summer, we worked on determining the porosity of core samples using point counting and Fiji image analysis software on high resolution scans of petrographic thin sections. Additionally, we used RediCore software to relate optical and radiographic images of the core to elemental data. Integration of the results of these various analyses forms the base for a comprehensive comparative study of different rock types represented in the core.

For the second project we analyzed the data collected in the field by using drone and RFID (radio frequency identification) technologies to track movement of large rock boulders by storm waves. Specifically, we compared drone images from 2020 to those acquired in 2016 and 2017 after Hurricane Joaquin made a landfall on the island in October 2015 (Figure 1). We also compared photographs and information about location of boulders tagged using RFID between June 2019 and January 2020 to document their movement by waves in the absence of major hurricanes. We used ArcMap to pin the location of tagged boulders and to create digital elevation maps and transects utilizing data from the drone for comparison with transects measured manually in 2012. This work further highlights the impact of storms on low elevation coastlines of small tropical islands and provides a robust database for future comparative analyses within this long-term monitoring study. We will be presenting the results of this work as two posters at the Geological Society of America (GSA) Online Gathering in October 2020.

SURF Abstract Submission & Post Program Survey 2020

Name

Hallie Brown

Year of Graduation

2021

SURF Advisor

Shepard, Caitlin Psychology

SURF Field of Study

Psychology (specifically, eating disorder research)

Title of Abstract/Research   ACT iCoach for Disordered Eating: Feasibility, Acceptability, and Preliminary Outcomes

Please type your abstract below.

Eating disorders have a high level of resistance to treatment, in part due to their ego-syntonic nature (Halmi, 2013). Acceptance and Commitment Therapy (ACT), based in addressing experiential avoidance, increasing psychological flexibility, and increasing motivation, could be quite useful in the treatment of eating disorders, which often involve some component of experiential avoidance, attempts to control intrusive thoughts, and low motivation for change (Baer et al., 2005; Hayes & Pankey, 2002; Juarascio et al., 2010). Another barrier to eating disorder treatment comes in the form of difficulty accessing care. This can affect college students in particular. College counseling centers are often understaffed, with an average ratio of one counselor to every 2,081 students (Gallagher, 2015). The use of mental health apps has been explored as one option to increase the accessibility of treatment for issues ranging from depression and anxiety to eating disorders (Bakker et al., 2018; Haeger et al., 2020; Juarascio et al., 2015; Neumayr et al., 2019). A gap exists, however, regarding research on mobile ACT interventions for eating disorders specifically. An effective, app-based ACT intervention could be a helpful solution to the problem of long wait times at college counseling centers.

Over the course of this summer research project, a small intervention study was planned to evaluate the feasibility, acceptability, and preliminary outcomes of the ACT iCoach app in a sample of college students with disordered eating. First, research was conducted on the ACT framework and stages of intervention research. Existing research was reviewed on both ACT for eating disorders and mobile health interventions. Several apps were reviewed as potential candidates for the intervention, and ACT iCoach was selected. The study design was determined, including outlining intervention procedures, selecting measures for data collection, and making logistical decisions regarding study details. A statement of purpose was written and submitted to the app company to request permission for use. An IRB protocol was also completed and submitted for review. The intervention will be carried out over the next academic year. Data collected through this project will be used in two student thesis projects.

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SURF Abstract Submission & Post Program Survey 2020

Name   Hannah Rappaport

Year of Graduation   2022

SURF Advisor   Katz, Laura; Biological Sciences

SURF Field of Study   Biological Sciences

Title of Abstract/Research   Transcriptomics and Pitcher Plant Microbial Diversity

Please type your abstract below.

I worked on two main projects this summer. The first was the beginnings of transcriptome analysis of organisms within the eukaryotic clade of Rhizaria, mainly the testate amoebae foraminifera (forams) and euglyphids. Because the genetics of these organisms is understudied, there are no reference sequences for the majority of forams. Another consideration is that our samples contain contaminants from other organisms, both bacteria and other eukaryotes. We visualized Rhizarian whole transcriptome analysis (WTA) sequence clusters using the VizBin application and produced GC content plots to begin to parse out target organism vs. contaminant sequences. Future work should include an expanded use of the Basic Local Alignment Search Tool (BLAST) and BLASTX to compare sample sequences to any available reference sequences, eventually being able to curate reference sequences of our target organisms and continue answering questions about the structure of their transcriptomes.

The second project is an analysis of the microbial communities living within Nepenthes pitcher plants and bromeliads, both types of plants with water-filled cavities, of the Smith College Botanic Garden. I worked with Jailene Gonzalez '22. Our focus is on the changes in microbial community structure between different stages of pitcher development, but without access to the lab/botanic garden this summer, we analyzed a combination of greenhouse data collected from the past two years and began writing a manuscript. We analyzed and created visualizations of the diversity of microbial eukaryotes from the supergroup, SAR, within these inquiline communities. Analyses included Principal Coordinates Analysis (PCoA), heat maps, charts of the most abundant organisms, and graphs of the rare biosphere. We also took a closer look into the phylogeny of potential greenhouse-specific ciliates.

SURF Abstract Submission & Post Program Survey 2020

Name   Hannah Wang

Year of Graduation   2021

SURF Advisor   Williams, Steven; Biological Sciences

SURF Field of Study   Biological Sciences

Please list co-authors of your abstract (if applicable)   Jordan Stauduhar, Sara Halili, Rachel Pietrow, Rachael Newhall, Allison Ahern

**Title of Abstract/Research**   Novel Assembly and Annotation of Aedes polynesiensis genome

Please type your abstract below.

Aedes polynesiensis is a mosquito species endemic to South Pacific islands. This mosquito is a vector for multiple diseases including lymphatic filariasis and dengue, a neglected tropical disease that mostly affects the billion people worldwide with the least resources. While the genome of many related species such as Aedes aegypti have been sequenced multiple times, the genome of A. polynesiensis has yet to be sequenced and annotated. The goal of this project is to establish an assembled genome that will provide insight into the species' effectiveness as a vector for diseases like lymphatic filariasis. A. polynesiensis sequence data was collected by Renna Bushko, a masters student in the Williams Lab. Through her work with New England BioLabs, we were able to attain hybrid assembly data from second and third generation sequencing technologies. We then used the programs ABySS and DBG2OLC to assemble short reads and long reads of our DNA, respectively. Although we could not determine a complete assembly from DBG2OLC, we proceeded with the result we obtained from ABySS. Through the genome annotation program MAKER and manual annotation of salivary gland, sex determining, olfactory, and insecticide resistance genes, we were able to detemine the location and sequence of multiple genes in A. polynesiensis. These genes may provide insight into the ability of the mosquito to act as a major vector of lymphatic filariasis in the South Pacific. Future research is needed to continue this project and determine a complete annotation of Aedes polynesiensis. We will continue working on improving the performance of programs such as DBG2OLC as well as manually annotating relevant gene families.

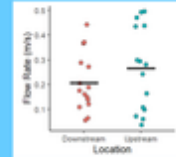# SURF Abstract Submission & Post Program Survey 2020

Name

Heather McQueen

Year of Graduation

2020

SURF Advisor

Crouser, Jordan; Computer Science

SURF Field of Study

Computer Science
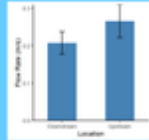
Title of Abstract/Research

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SURF Abstract Submission & Post Program Survey 2020

Name   Helen Wang

Year of Graduation   2022

SURF Advisor   Dorit, Robert; Biological Sciences

SURF Field of Study   Biology

Title of Abstract/Research   Quantitating the Costs of Colicin Resistance

Please type your abstract below.

While antimicrobials have proven valuable in the fight against bacterial infections, their misuse and overuse have led to the increased prevalence of antimicrobial resistance. This growing problem, coupled with increased awareness of the bacterial microbiome's importance in human health, have led to a growing interest in narrow spectrum antimicrobials. Bacteriocins are one such class of targeted antibiotics: bacterially-produced toxins that kill or inhibit other closely-related bacteria, utilizing a variety of mechanisms. In this study, I focus on colicins, bacteriocins produced by E. coli, as a model for studying the emergence and costs of bacteriocin resistance.

While I was not able to conduct experiments in the lab this summer, I had access to data from experiments conducted during the school year. I wrote an R script that analyzes growth curve OD data and returns many growth metrics, including average OD values; first and second derivative values; standard deviation values for the OD, first, and second derivatives; lag time; and accompanying graphs for all. This computational pipeline will allow us to compare the growth dynamics of several strains, and to quantitate the precise costs of developing colicin resistance. For example, the first derivative can be used to calculate the max growth rate each strain reached, and the lag time shows how long it takes for the strain to adapt to growth conditions and begin dividing. Changes in these values (a decrease in max growth rate or an increase in lag time) between the initial sensitive strain and the bacteriocin-resistant strains quantitate the costs of resistance.

We also devised an experimental plan for the academic year. Combined with my script, several refinements should improve the efficiency and results of our lab work. These include standardizing samples for lysate production and live growth curves, and ensuring equal exposure to lab conditions for all strains. We hope to progress to conducting competition experiments when access to the lab is restored, which will allow us to directly compare the fitness of strains.

SURF Abstract Submission & Post Program Survey 2020

Name   Jenna Croteau

Year of Graduation   2021

SURF Advisor   de Villiers, Jill; Psychology

SURF Field of Study   Psychology/Linguistics

Title of Abstract/Research   Prelinguistic Sortals: Nonverbal Infant Representations of
                                       Food and Edibility

Please type your abstract below.

Sortals are concepts that provide specific principles of identity and individuation that allow objects to be represented differently from one another (Xu, 2007, p. 400). Principles of individuation allow us to define an object as a member of a particular category or kind. By contrast, principles of identity allow us to state whether an object is identical to another. While some kernel of these principles exists in newborn human infants (Izard, Sann, Spelke & Sterir, 2009; Valenza, Leo, Gava, & Simion, 2006), full development of these principles does not come online until around 12 months of age or at about the same time that infants acquire their first words (Xu, 2007). The present study is aimed at answering the following question: do infants possess early developing principles of individuation and identity that would facilitate their ability to categorize objects as FOOD and NON-FOOD. In other words, could representations of food be "pre-programmed" into human infants?

In order to answer the above question, a violation-of-expectation (VOE) study is currently being conducted virtually over Zoom. Participants are 8-11 month old full-term, healthy infants. Infant-caregiver pairs sit in front of their computer and view a series of pre-recorded videos. These videos are broken down into three event categories: familiarization/baseline trials, priming trials, and a final test trial. The familiarization events consist of common household objects appearing and disappearing behind an occluding screen. The occluding screen is lifted to reveal either one or two objects and infant looking behavior is observed. Priming events consist of an actor interacting with two fake fruit-like objects. This actor either eats the fruit or turns away in disgust from the fruit in the experimental condition, while in the control condition the actor simply interacts with the object by putting it on her head. Finally, in the test event infants watch as the fruits appear/disappear behind the occluder. The occluder is lifted to display a mismatch (only 1 fruit object is displayed). Looking behavior is recorded and compared across conditions.

Data collection will continue into the fall and spring semesters. Preliminary data suggests that some minor modifications to the stimulus and experiment design will be necessary in order to better engage infants' attention. This study is of particular interest due to the lack of research conducted on early infant capabilities to identify and categorize food objects (Paroche et al, 2017). The researchers hope to contribute valuable empirical evidence on early food representations in young infants.

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SURF Abstract Submission & Post Program Survey 2020

Name   Jiwoo Seo

Year of Graduation   2021

SURF Advisor   McKahn, Denise; Engineering

SURF Field of Study   Engineering

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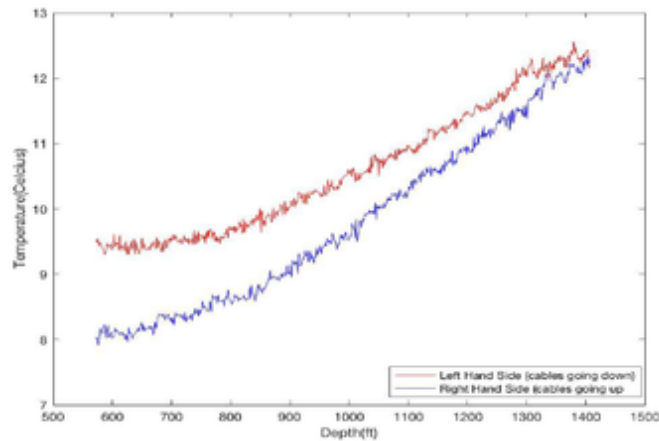
Title of Abstract/Research

Thermal Modeling of Coaxial Geothermal Heat Exchangers on Smith Campus

Please type your abstract below.

Smith College's 2030 Carbon Neutrality Plan incorporates an on-site District Energy Plan that plans to install a ground-source heat exchange system in the College's athletic fields [1]. This system includes the installation of a geothermal heat exchanger, which would use geothermal energy to heat/cool the College's buildings [1]. Geothermal energy is a type of thermal energy that is stored within the earth and can be leveraged through direct thermal extraction or be coupled with a heat exchanger installed in the ground for ground-source heating/cooling [2]. This energy is used to either produce electricity or be used directly for thermal applications [3] [4]. In a geothermal heat exchanger, geothermal fluid travels through the heat exchanger and thermal energy is either extracted from or rejected into the ground. The fluid travels to the bottom and back to the top of the borehole, and then is circulated through the buildings that require heating/cooling. The process is repeated when the fluid returns to the borehole after circulation. My work principally investigated the work of Mabel Jiang, a Smith engineering honors thesis student, who developed a one-dimensional, control-oriented thermal model for the coaxial geothermal heat exchanger installed at the Smith College Fieldhouse [5]. In her work, after specifying a fiber optic cable and designing a thermal model, the cable was installed in the borehole, looped around the surface of the pipes in a U-shape [5]. The temperature data down the borehole were measured by the Distributed Temperature Sensing (DTS) system. Using the processed data, she concluded that the measurement of temperature by the DTS was influenced by light scattering [5]. As shown in the graph, the two temperature readings at a certain depth are different down the length of the cable, when theoretically, they should be of identical values if both halves of the cable were at equal depth. To identify the errors that have caused the error in the thermal model, this summer, my research focused on developing models in MATLAB that calibrate temperature data from the coaxial geothermal heat exchanger and calculate the temperature difference between the DTS temperature data and the hobo temperature data measured in the Fieldhouse with water baths [6].

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[3] "Geothermal Energy - Green Building Alliance." https://www.go-gba.org/resources/green-building-methods/geothermal-energy/.

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[6] J. Seo, "Thesis Proposal for 'Dynamic Thermal Modeling of Coaxial Geothermal Heat Exchangers,'" Smith College, 2020.

SURF Abstract Submission & Post Program Survey 2020

Name   Jordan Stauduhar

Year of Graduation   2021

SURF Advisor   Williams, Steven; Biological Sciences

SURF Field of Study   Bioinformatics

Title of Abstract/Research   Genome Assembly and Annotation of Aedes Polynesiensis

Please type your abstract below.

For SURF 2020, our team in the Williams lab tackled the genome assembly and annotation of Aedes polynesiensis. Although we are nowhere near close to being finished, we were able to learn a lot in our struggles over the summer. We started with genome assembly using sequence data gathered by masters student, Renna Bushko. For this step, we used hybrid genome assembler DBG2OLC. The assembly tool gave a very good N50 value (a stat used to determine how well the program was able to piece the DNA fragments together); however, when we moved to the annotation step, we found that our assembly had major gaps in the DNA meaning that we could not fully annotate our genome with MAKER automated annotation. With no labs open to do additional sequencing, this problem gave us a minor setback in productivity, but we are hopeful that we can get more sequence data soon to try and improve our assembly. Along with assembly and automated annotation, we also did some manual annotation of gene families of interest. For this, we used NCBI and BLAST to find genes in related species to pull these sequences out of our polynesiensis genome. We focused on genes in the salivary glands, the sex determining M locus, olfactory receptors, and insecticide resistance. Since our genome is still very contiguous, this step has taken us extra time and we are just scratching the surface of this part of our project. We hope to continue our research as a special studies for the Fall 2020 semester.

SURF Abstract Submission & Post Program Survey 2020

Name   Julia Clark

Year of Graduation   2021

SURF Advisor   Voss, Susan; Engineering

SURF Field of Study   Engineering

Title of Abstract/Research   Reformatting and Expanding the Wideband Acoustic Immittance (WAI) Database

Please type your abstract below.

Wideband Acoustic Immittance (WAI) measurements can be used to noninvasively diagnose different ear pathologies. The WAI Database is an online collection of WAI measurements across multiple published studies. Previously, the only data included in the WAI database was data from normal Adult ears at ambient pressure. This summer, I updated and reformatted the database to have the ability to include data from subjects of all ages, data from abnormal ears, and pressurized data with upswept and downswept measurements.

We reached out to authors of published papers with WAI data and received new data to add to the database. The new data we received included abnormal ears, data from infant and NICU baby ears, and pressurized measurements. I used MATLAB to format the new data and to reformat the tables already included in the database to match the new format.

To make sure the data in the database matches the corresponding published data, I read the paper for each study and found a figure with which I could compare the data in the database. Using the data in the database for that study, I recreated the figure from the article using MATLAB. Then, I used a program in MATLAB called DataTheif that captures the coordinates of points on a line of a graph to plot the figure directly from the published article. I plotted the recreated figure from the database and the recreated figure from the article via DataTheif on the same plot to compare. This check made sure we put the correct data in the database before we officially uploaded it. After uploading the data to the database in its checked and reformatted form, I used mySQL to download the data tables and recheck each study to confirm we uploaded the data correctly.

The main outcome is that the WAI Database is restructured and able to include WAI data that is not just normal Adult ears at ambient pressure, so the database can expand and have more available for its users.

Future work includes reaching out and receiving data from more published studies to expand the types of ear pathologies in the database, to include data from subjects of all ages, and to include more pressurized data.

SURF Abstract Submission & Post Program Survey 2020

Name   Julia Frothingham

Year of Graduation   2023

SURF Advisor   Fortune, Nathaneal; Physics

SURF Field of Study   Physics

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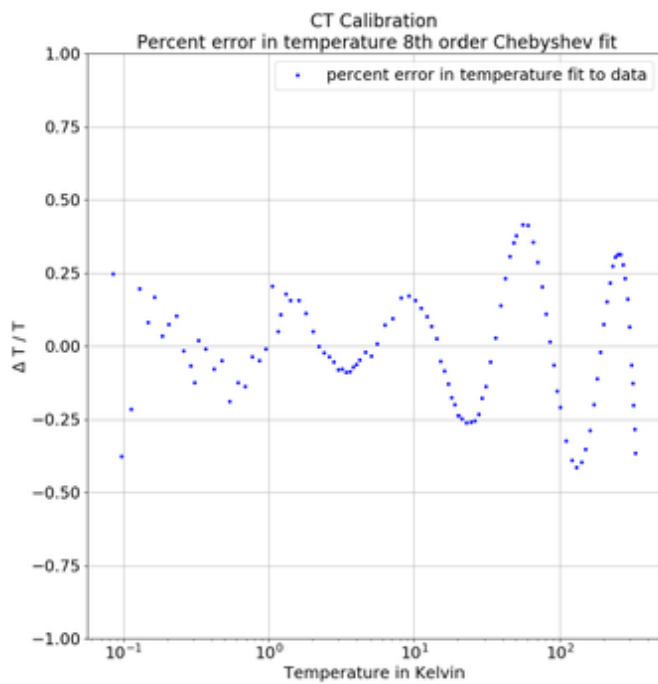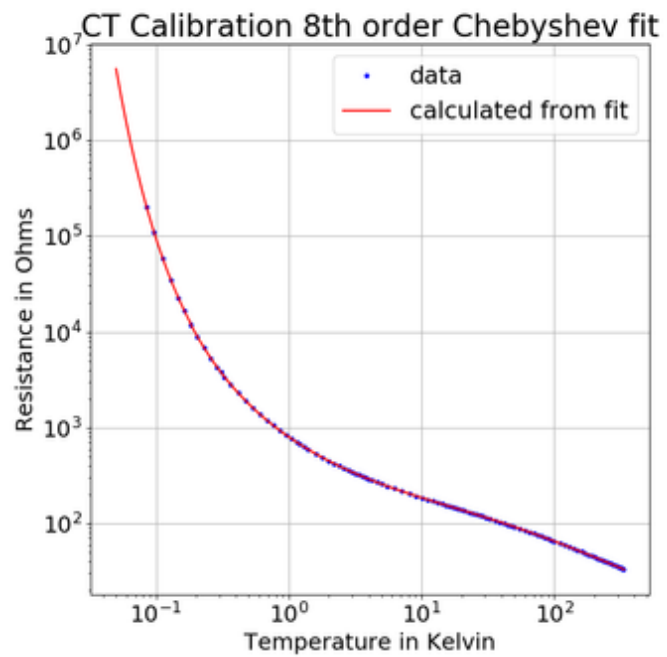
Title of Abstract/Research

Creating a Python package for correction of magnetic field dependence of resistive temperature sensors

Please type your abstract below.

Resistive thermometers are important tools used to measure temperature in many different laboratory and experimental settings. In combination with a calibration curve, often provided with the thermometer, the temperature can be determined by measuring the resistance of the thermometer. However, non-zero magnetic fields also affect the thermometer's resistance. Recalibration of the thermometer is required for every use in a different magnetic field. This can be a lengthy process.

Professor Nathanael Fortune addresses this problem in an invited paper currently in preparation for the Journal of Low Temperature Physics. His mathematical modeling and associated Python code demonstrate the use of a one-time calibration process to characterize how the impacts of a magnetic field on a resistive thermometer's temperature-resistance relationship change with field strength. This stored characterization enables users to quickly generate calibration curves for temperature and resistance in different magnetic fields, allowing more efficient use of the resistive thermometer for data collection in field.

My work this summer focused on reorganizing and improving the Python code in preparation for its publication as a supplement to Professor Fortune's paper. I streamlined the code and removed redundancies by bundling custom-defined functions into a package and defining a class. In developing the class, I automated certain functions and increased user control over others. I created extensive documentation in the form of a wiki included with the published code. This wiki can serve as a code reference and a step-by-step guide with detailed explanations and examples for anyone using the code.

I also researched and began testing several methods using a look-up table of values with interpolation to calculate temperature from resistance and magnetic field strength. This would be more efficient than the current calculation method, but full implementation was outside the scope of this project and so is not included in the finalized version of the code.

Future work on the project could include further expansion of the wiki and more detailed examples of code use with additional datasets. The code could be improved with the implementation of more sophisticated data import/export routines, some sort of way to use and keep track of the metadata associated with data files, and further development of my initial work with look-up tables and interpolation.

My work on this project can be viewed at: https://gitlab.com/smith-college-physics/fortune-lab/thermometry-in-magnetic-fields

SURF Abstract Submission & Post Program Survey 2020

Name

Katherine Berry

Year of Graduation

2021

SURF Advisor

Shepard, Caitlin; Psychology

SURF Field of Study

Title of Abstract/Research   Food and Alcohol Disturbance Among US College Students: A Systematic Review

Please type your abstract below.

Disordered eating and problematic alcohol use are considered primary health concerns on college campuses. Research suggests that these behaviors often co-occur and may serve coping or emotional regulation functions (e.g., Anderson et al., 2006; Buckholdt et al., 2015). A growing body of research has highlighted that a reciprocal association between disordered eating and alcohol use might exist for some individuals, referred to as "food and alcohol disturbance" (FAD). Terminology, conceptualizations, and operational definition are inconsistent and vary across the nascent FAD literature. Such inconsistencies make it difficult to synthesize information across studies and draw conclusions about FAD, thus impeding our knowledge of this phenomenon (Piazza-Gardner & Barry, 2013).

The purpose of my SURF project was to review and synthesize the existing FAD literature to help provide further insight into the scope of this problem on US college campuses, identify gaps and limitations in the existing literature, and offer direction for prevention and intervention efforts. More specifically, my review aimed to (1) examine how FAD has been identified in the current literature, (2) determine the estimated prevalence rates of FAD, and how this differs according to demographic factors and campus subgroups, (3) identify the psychological and social correlates of FAD, and (4) investigate the consequences of FAD. Our review found that FAD is common among US college students and could result in negative consequences. In addition, our review provided several considerations and recommendations for future research.

Findings from my SURF project were submitted to an academic peer-reviewed journal for publication and presented at the American Psychological Association conference.

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Piazza-Gardner, A., & Barry, A. (2013). Appropriate Terminology for the Alcohol, Eating, and Physical Activity Relationship. Journal of American College Health, 61(5), 311–313.

SURF Abstract Submission & Post Program Survey 2020

Name   Kristine Lu

Year of Graduation   2021

SURF Advisor   Glumac, Bosiljka; Geosciences

SURF Field of Study   Geoscience

Please list co-authors of your abstract (if applicable)   Victoire Raissa Mugabekazi '21 and George Pharris '22

Title of Abstract/Research   Impact of storms, sea-level fluctuations and climate changes on modern and Pleistocene environments of San Salvador Island, Bahamas

Please type your abstract below.

Using samples and data collected during the GEO 334 Carbonate Sedimentology January 2020 trip to San Salvador Island, Bahamas, and the following Spring 2020 course, we undertook two remote research projects this summer: 1) analysis of a core through a Pleistocene coral reef; and 2) evaluation of the impact of storms on two coastal sites on San Salvador. The first project focused on carbonate deposits from a 34 m deep core formed during the last interglacial period, ~125,000 years ago, when sea level was ~6 meters higher than present. These deposits provide important insights into the makeup and health of coral reefs in times of warm climate and high sea levels. Our research aims at documenting the distribution and impact of thick algal and microbial encrusters on corals within this fossil reef. Such encrusters can fill pore space in the reefal framework, altering porosity and permeability of these rocks and modifying their fluid storing and transporting properties. We investigated selected core samples using a variety of methods. Last spring we collected GeoTek density measurements along with iTrax core scanner radiographs and X-ray fluorescence (XRF) elemental data at the University of Massachusetts, Amherst. We also sent samples to the Special Core Analysis Laboratory in Texas for permeability, porosity and grain density measurements and CT scanning. During the summer, we worked on determining the porosity of core samples using point counting and Fiji image analysis software on high resolution scans of petrographic thin sections. Additionally, we used RediCore software to relate optical and radiographic images of the core to elemental data. Integration of the results of these various analyses forms the base for a comprehensive comparative study of different rock types represented in the core.

For the second project we analyzed the data collected in the field by using drone and RFID (radio frequency identification) technologies to track movement of large rock boulders by storm waves. Specifically, we compared drone images from 2020 to those acquired in 2016 and 2017 after Hurricane Joaquin made a landfall on the island in October 2015. We also compared photographs and information about location of boulders tagged using RFID between June 2019 and January 2020 to document their movement by waves in the absence of major hurricanes. We used ArcMap to pin the location of tagged boulders and to create digital elevation maps and transects utilizing data from the drone for comparison with transects measured manually in 2012 (Figure 1). This work further highlights the impact of storms on low elevation coastlines of small tropical islands and provides a robust database for future comparative analyses within this long-term monitoring study. We will be presenting the results of this work as two posters at the Geological Society of America (GSA) Online Gathering in October 2020.

SURF Abstract Submission & Post Program Survey 2020

Name   Kylee White-Ramirez

Year of Graduation   2022

SURF Advisor   Barresi, Michael; Biological Sciences

SURF Field of Study   Developmental Biology

Title of Abstract/Research   Modeling the Effect of Meteorin Promoter-less Knock-out on
                                    Zebrafish Brain Development

Please type your abstract below.

Meteorin is a glial cell differentiation factor found in vertebrate nervous system. It is specifically expressed in vertebrate nervous systems by neuroglial progenitor cells as well as differentiated astrocytes. In order to get a better understanding of Meteorin's purpose in zebrafish brain development, a promotor-less knockout needs to be observed. Over the summer, we spent time mapping out the promoter region. In addition to this project, I completed two online courses that focus on R Basics and Introduction to Neuroscience. I also took a lesson on animation using Adobe Animate with the goal of creating animations of scientific concepts. I was able to complete an animation of dechorionating a zebrafish embryo.

SURF Abstract Submission & Post Program Survey 2020

Name	Lara Brown
Year of Graduation	2022
SURF Advisor	Barresi, Michael; Biological Sciences
SURF Field of Study	Developmental Biology

Title of Abstract/Research   Examining the Role of Bioelectrics in Danio rerio Early Development

Please type your abstract below.

What determines which side of a developing embryo turns into a head and which side becomes the feet? Developmental biologists are working to understand the big-picture events and feedback loops that play a role in animal axis determination. One potential mechanism for such patterning is bioelectrics, which describes gradients of cell membrane resting potential in non-neuronal cell types. Most cells have a negative charge relative to extracellular fluid. When this differential is more extreme, membranes are considered hyperpolarized; when it is less extreme, membranes are considered depolarized. Different cell types have different baseline membrane potentials.

Gradients of non-neuronal membrane potentials measured across organisms as early as the 1930s led scientists to wonder whether bioelectrics may play an instructive role in tissue patterning during embryonic development and regeneration (1,2). With the recent advent of genetic and molecular tools to perturb organisms at finer scales, the field of bioelectrics has grown, particularly with regard to regeneration. However, few recent studies have concerned themselves with the early developing embryo, particularly in vertebrate systems. The Barresi Lab Bioelectrics Group is interested in understanding how early patterns of membrane potential may be critical in orienting axes in zebrafish.

This summer, I conducted a literature review to further my understanding of bioelectrics and developmental biology. I compiled my findings in a concept map using Adobe Photoshop. Additionally, I developed another concept map specifically pertaining to potassium transport, integrating information on different modes of potassium signaling as well as expression patterns of different potassium channels in zebrafish. The Bioelectrics Group and I developed a ranked list of ion channels of particular interest for further study due to their early asymmetric expression. Asymmetric expression patterns are a potential indicator that the channel in question may be connected to axis determination and pattern formation in the early embryo.

Prior to COVID19, we began to develop transgenic lines of zebrafish ubiquitously expressing genetically encoded voltage indicators (GEVIs), which localize to the cell membrane and fluoresce at different intensities depending on membrane potential. GEVIs are a powerful tool to visualize bioelectric patterns, and their rapid response times enable us to view near instantaneous changes to bioelectric states. I developed a spreadsheet to track published GEVIs and particularly sought to identify those that had previously been used in zebrafish or Xenopus (frog). This work enabled us to identify potential constructs for use in our transgenic lines, including Voltron (3), ASAP1 (4), and Archon1 (5).

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SURF Abstract Submission & Post Program Survey 2020

Name   Madeleine Lerner

Year of Graduation
                                                2020

SURF Advisor   Beery, Annaliese; Psychology/Neuroscience

SURF Field of Study   Neuroscience

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

Title of Abstract/Research   Effects of stress on partner preference formation and group sociability in prairie voles

Please type your abstract below.

Effects of acute stress on partner preference formation

Previous research has revealed that stress can have a profound effect on various aspects of social behavior in prairie voles (Microtus ochrogaster) as well as the closely related meadow voles (Microtus pennsylvanicus). Exposure to acute stress, whether through environmental stressors (i.e., a swim test) or exogenous corticosterone (CORT) administration (via injection or drinking water) can affect the formation process of selective partner preferences in voles. Research on opposite-sex prairie vole mate pairs suggests that stress or artificially elevated CORT levels can have a sexually dimorphic effect, facilitating pair bonding of male prairie voles to female voles, but inhibiting bonding of female to male voles. Similarly, research on meadow voles suggests that stress can inhibit the formation of partner preference in female peers. The effect of stress on selective peer relationships between female prairie voles is unknown. However, some unpublished research suggests that stress may facilitate peer bonding and the development of partner preference between female prairie vole peers. Our research aims to explore this phenomenon and determine whether stress inhibits or facilitates the formation of peer bonds in female prairie voles.

Although acute stress has pronounced effects on bond formation in voles, it does not appear to have an effect on bond maintenance in meadow voles. Exposing established meadow vole pairs to an acute stressor did not affect huddling time in the PPT, which remained high in peer partners compared to strangers.

Stress and group dynamics

The group sociability of meadow voles changes seasonally. In the summer, induced by long daylight hours, meadow voles are territorial and aggressive toward conspecifics. In the winter, induced by short daylight hours, meadow voles form peer social groups and show affiliative behavior. These behavioral changes are accompanied by seasonal changes in CORT levels, which are thought to be related to the changing sociability. Besides this, there is little research about the direct effects of stress on group social behavior in voles. However, in groups of male rats, exposure to an acute stressor increased the amount of time spent huddling in a group, but not in pairs, suggesting that acute stressors may affect group dynamics in group-living species. In our research, we aim to examine the effects of stress not only on peer bonding, but on overall group dynamics and group-level social interactions in prairie voles.

SURF Abstract Submission & Post Program Survey 2020

Name

Marie Bermudez

Year of Graduation

2021

SURF Advisor

Vriezen, Chris; Biological Sciences

SURF Field of Study

Biology

Title of Abstract/Research   Identification of soil-borne bacteria

Please type your abstract below.

The identification of secondary metabolites that have antimicrobial properties is very important to the exploration of novel antibiotics. The significance of the exploration of secondary metabolites in bacteria is to identify toxins that can be exploited to develop new antibiotics. Therefore, the purpose of the work accomplished during the summer of 2020 was to edit 16S sequences and determine the identities of soil isolates from four environments: Grassland Surface (GS), Grassland Subsurface (GSS), Forest Surface (FS), and Forest Subsurface (FSS). The results of this work would be helpful for future studies on these bacterial isolates and their products such as secondary metabolites.

This research project focused on 89 soil isolates from MacLeish Field. The methods followed were: editing of 16S sequences on 4peaks software, assembly of sequence files on Lasergene software, NCBI BLAST searches for representative genomes, and literature evaluation on morphology.

The results collected in this research reveal information needed for protocol design and future studies on the sampled community profiles and secondary metabolite production of these isolates. Some of the conclusions made from the summer project were that the molecular identification of the bacterial isolates using 16S sequences reveals that the most predominant bacteria are Bacillus toyonensis and Bacillus mycoides. Furthermore, the two most common genera overall were Bacillus and Paenibacillus. These findings are significant for future studies on the production of antimicrobial compounds by soil isolates. Specifically, Paenibacillus strains are of interest to future studies because of their properties of secondary metabolite production. For example, the antimicrobial compounds produced by Paenibacillus strains may "be useful for post-harvest control of food-borne bacteria, such as Salmonella, that are pathogenic to humans" (Grady et al). The next steps will be to finish identifying the remaining bacterial isolates that need sequencing. Then, future studies will focus on the exploration of novel bacterial soil isolates on the genomic level to evaluate the potential for the production of secondary metabolites.

SURF Abstract Submission & Post Program Survey 2020

Name   Megan Varnum

Year of Graduation
                                       2023
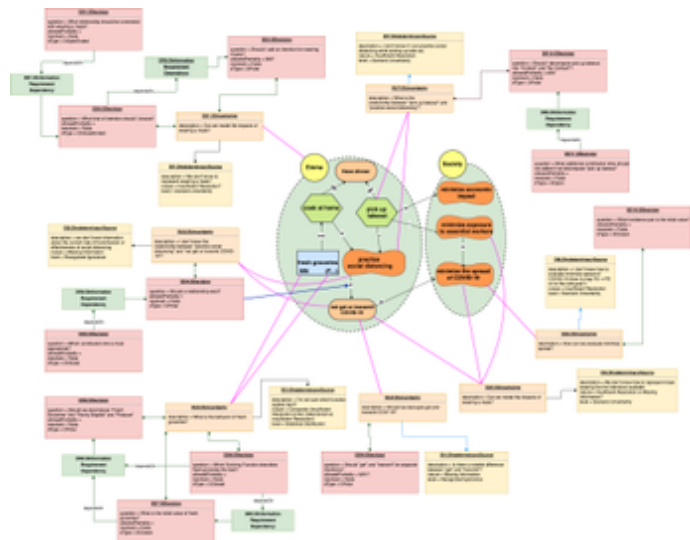
SURF Advisor   Grubb, Alicia; Computer Science

SURF Field of Study   Computer Science (Software & Requirements Engineering)

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

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

Title of Abstract/Research   Exploring Uncertainties in COVID-19 Modeling

Please type your abstract below.

Goal Modeling is used in early phases of projects to evaluate tradeoffs with stakeholders. These models consist of intentions, such as goals, tasks and resources, and are encapsulated in actors that represent stakeholders. These intentions are then connected with links, such as '++', '--', 'and', and 'or'. For example, [our attached figure] shows the actor Emma, who is a student deciding how to have dinner and has the goal of 'make dinner'.

In the spring of 2019, we observed the wide use of models to understand the evolving COVID-19 global pandemic. For example, Bayesian models were used to describe the spread of the virus. We aimed to understand how our goal modeling tools and analysis could be used to make tradeoff decisions in the context of this pandemic. Our SURF project focused on creating a case study of individual decisions in the early stages of the COVID-19 pandemic. Previous case studies were analyzed retroactively, and this crisis provides a unique opportunity to make relevant models and validate our technique as the pandemic progresses. We initially created a collection of goal models based on personas that reflected different stakeholder views of COVID-19. The personas varied in compliance with COVID-19 guidelines, and values, and were based on reactions to publicized models on the pandemic progression in Quebec, Canada.

The development of our case study enabled our collaboration with a team from the Geodes lab at the Université de Montréal to explore modeling and resolving uncertainties in requirements.
As a proof of concept, we focused on the Emma model (see figure) and evaluated the inherent uncertainties in our model using DRUIDE (Design and Requirements Uncertainty Integrated Development

SURF Abstract Submission & Post Program Survey 2020

Name   Mel Regan

Year of Graduation   2021

SURF Advisor   Beery, Annaliese; Psychology/Neuroscience

SURF Field of Study   Neurobiology

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

Title of Abstract/Research   Developmental oxytocin receptor density changes from adolescence to adulthood in Syrian and Siberian hamsters

Please type your abstract below.

Oxytocin and its receptor have been evolutionarily conserved due to oxytocin's integral role in reproduction and social behavior within the animal kingdom (Reviewed by Donaldson & Young, 2008). Previous research has linked the hormone protein to sociality based on the location and density of oxytocin receptors in the organism's brain (Insel & Shapiro, 1992, Beery et al., 2008, Campbell et al., 2009). Sociality especially in rodents can be defined as bonds between mother and offspring, peers or opposite sex pairing for reproduction purposes. The degree of sociality is dependent on the oxytocin receptor density within certain brain regions and drives the group living type, either being solitary or social (Insel et al., 1991). Phodopus sungorus and Mesocricetus auratus are solitary hamster species that as pups are social because of the relationship between mother and offspring and between pups, then gradually become solitary as they develop and age. This study uses oxytocin receptor autoradiography from 15 and 60 day old P. sungorus and M. auratus to determine if the development from adolescence to adulthood changes oxytocin receptor densities in specific brain regions to investigate a neurobiological reason for the shift in sociality. Significant receptor density changes occurred between day 15 and day 60 in the endopiriform nucleus for P. sungorus and in the prefrontal cortex, dorsal and ventral BNST in M. auratus. A comparison table of oxytocin receptor densities in 22 different adult rodent species can start to shed light onto the patterns that have emerged through evolution to contribute to species' socialites.

Beery, A. K., Lacey, E. A., & Francis, D. D. (2008). Oxytocin and vasopressin receptor distributions in a solitary and a social species of tuco-tuco (Ctenomys haigi and Ctenomys sociabilis). The Journal of Comparative Neurology, 507(6), 1847–1859. https://doi.org/10.1002/cne.21638

Campbell, P., Ophir, A. G., & Phelps, S. M. (2009). Central vasopressin and oxytocin receptor distributions in two species of singing mice. The Journal of Comparative Neurology, 516(4), 321–333. https://doi.org/10.1002/cne.22116

Donaldson, Z. R., & Young, L. J. (2008). Oxytocin, Vasopressin, and the Neurogenetics of Sociality. Science, 322(5903), 900–904. doi:10.1126/science.1158668

Insel TR, Gelhard R, Shapiro LE. The comparative distribution of forebrain receptors for neurohypophyseal peptides in monogamous and polygamous mice. Neuroscience. 1991;43(2–3):623–30.

Insel, T. R., & Shapiro, L. E. (1992). Oxytocin receptor distribution reflects social organization in

SURF Abstract Submission & Post Program Survey 2020

Name

Mercedes Woolley

Year of Graduation

2020

SURF Advisor

Frost, Randy; Psychology

SURF Field of Study

Psychology

Title of Abstract/Research   Online Anxiety Psychoeducation for Teens

Please type your abstract below.

The Covid-19 crisis has limited access to in person mental health interventions, which has lead to a shift in the delivery of mental health services to online platforms. As a result there is an increasing need to develop attractive online programs to help deliver basic mental health interventions.

Over the past several years, Edward Plimpton, PhD and Randy Frost, PhD have been training Smith undergraduates to assist clinicians in helping anxious clients face their fears. This program has been particularly successful with adolescent and middle school children who have struggled with OCD and Social Phobias. For these adolescents, having a Smith undergraduate to coach them has been immensely effective. The undergraduate interns are old enough to provide some guidance and yet young enough to easily relate the social culture of these adolescents. Quite simply many adolescents find it more appealing to take suggestions from the undergraduate interns than from vastly more experienced seasoned clinicians.

There is some evidence that adolescents and tweens are more vulnerable to the effects of stress compared to adults. The long term effects of the current crisis on the nation's youth remain to be determined. However, it is clear that at this time psychoeducation and mental health services need to be delivered immediately and virtually.

The psychoeducational programs provided for anxious adolescents online has never utilized college students to deliver the material. Typically, it is a very seasoned therapist who might develop an online program for OCD or Social Phobia. In general, we have found these programs while conceptual and therapeutically accurate have not been especially appealing to anxious adolescents.

What has been developed over the past several months is a series of nine, approximately 10 minute videos that deliver accurate psychoeducation on topics related to OCD and anxiety, including topics of perfectionism, intrusive thoughts, stagefright, and exposure therapy. The videos were crafted in a style similar to that of popular YouTubers and vloggers in order to appeal to adolescent populations. The package of videos was piloted to several teenage patients of Dr. Plimpton. The purpose of piloting the program was to receive feedback and to understand what video components patients found not only attractive but effective. This feedback will be formative for future videos made on related topics and suggests something about the style of psychoeducation effective for teenagers.

Next steps will involve determining how to get views and deliver this program appropriately to the targeted audience. This program could also be useful in demonstrating to clinicians how to best communicate material to younger patients. Though this program is still in the beginning stages, it is clear that some younger patients may find this type of material valuable in treatment. Further investigation could involve a variety of questionnaires to determine the effectiveness in a larger group of patients.

SURF Abstract Submission & Post Program Survey 2020

Name   Michaela Guy

Year of Graduation   2022

SURF Advisor   Peckol, Paulette; Biological Sciences

SURF Field of Study   Marine Biology

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

Catherine Park, Perryne Vega

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

SURF research during the COVID pandemic: effects of climate change and environmental racism on coastal communities

Michaela Guy, Catherine Park and Perryne Vega

Due to COVID-19, Smith College was closed for the summer and students conducting SURF research needed to do so remotely. Our summer work included: 1) keeping a reflective journal that addressed questions and concerns that arose throughout the summer, 2) reading and discussing scholarly articles in the field of marine science on topics of habitat degradation and environmental justice, 3) designing and conducting short field studies as a group and individually, and 4) working independently in a growth/leadership area of our selection. We met for Zoom meetings twice per week to discuss our reflective journal response and scientific findings. Here, we detail some of our remote work.

While working remotely, we focused on marine policies and discussed the pandemic and social justice issues. Our research was guided by considering solutions to environmental and societal problems in marine communities. All of us maintained journals that chronicled our thoughts on these topics. Each entry reflected the growth of our opinions and understanding. Catalyzing this growth was the integration of social justice topics into our marine science literature (e.g., intersection between racism, classism, and the establishment of marine protected areas). We designed and conducted two observational studies. The first group study focused on the percentage of males vs females wearing masks. We analyzed the data as a team. We worked independently for the second field project, studying specific activities and behavior of selected animal species. We discussed these projects as a group, fine-tuning our methodology and analyses. This summer also included individual personal growth projects. RStudio coding was part of two personal projects with Catherine Park expanding her skills in data visualization and analysis of the life sciences, and Michaela Guy using it to supplement her reflections on social justice and the Black Lives Matter Movement. Perryne Vega's independent project explored COVID-19 effects on fisheries, specifically looking at marginalized groups and highlighting the downfalls of systems set in place to support minority groups.

Though we were unable to conduct field/lab studies in marine science, this SURF experience provided us with many skills relevant to the field. While we considered the pervasive environmental racism embedded in many policies at national and international levels, we studied successful policies and brainstormed ideas for greater equity and involvement of all stakeholders. Finally, our independent projects enabled us to explore more individualized areas of interest that have enriched our Smith learning experience.

Faculty advisor: Paulette Peckol

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Faculty advisor: Paulette Peckol

SURF Abstract Submission & Post Program Survey 2020

Name   Naomi Ostriker

Year of Graduation   2021

SURF Advisor   Katz, Laura; Biological Sciences

SURF Field of Study   Biological Sciences

Title of Abstract/Research   Characterizing mechanisms of shell-building in the Arcellinid testate amoebae

Please type your abstract below.

The testate amoebae are a highly diverse, non-monophyletic clade of eukaryotic protists. The order Arcellinida, like all testates, are universally characterized by the presence of a single-aperture test that encloses the cell body, as well as the presence of thick, or lobose, pseudopodia. They are present globally and are important contributors to the nutrient cycling of their environments. However, despite their extreme environmental significance and global dispersion, the physiology and molecular mechanisms of the Arcellinida are largely under-characterized, hindering our understanding of a clade that is tremendously widespread and essential to many ecosystems. In my research I expect to (1) characterize candidate genes for test-building in the Arcellinida; and (2) assess their active expression in dividing cells in order to better understand the molecular mechanisms of the shell-building process. Furthermore, I hypothesize that there exists a set of genes upregulated during the Arcellinid test-building process that can be observed, quantified, and identified. Because my project focuses on gene expression in cells undergoing shell-building, my data consist of whole single-cell transcriptomes. Over the course of SURF 2020, I used bioinformatic techniques to analyze transcriptomic data I gathered over the course of previous SURF and Special Studies projects.

SURF Abstract Submission & Post Program Survey 2020

Name   Nikki Sallis

Year of Graduation   2021

SURF Advisor   Clemans, Katherine; Psychology

SURF Field of Study   Peer Relations

Title of Abstract/Research   Sociometric Status and Social Goals Framework

Please type your abstract below.

This summer I explored two topics related to peer relations data from the APEX survey, which is a longitudinal data collection survey that was run at Amherst College. My primary analysis pertained to social status goals and sociometric status type. Using a model from Coie, Dodge, and Coppotelli, 1982, sociometric status types were identified using peer-nomination data where peer visibility and peer liking were combined to form four distinct types. I conducted an extensive literature review of articles using this specific sociometric status measure and investigated possible correlates. Based on my findings I created a goal-resources-outcome framework for popularity status in young adults.

The APEX study measures social goal data in two distinct ways: friendship goals and popularity goals. I hypothesized that friendship goals would correlate to variability in peer liking and popularity would correlate to variability in peer visibility measures. While many articles use specific strategies or personality traits to predict sociometric status, those would fit more closely under the concept of resources in the proposed framework. Since there is such a wide spectrum of measures used and the APEX study is more of a general survey, not a study in social strategies or personality I decided to use attractiveness as the principle moderating variable between social goals and sociometric outcome.

Since the data from the APEX study is largely identifiable and uncleaned a large proportion of my SURF was spent trying to configure the data in order to get to a place where a statistical analysis can be run. The second topic of interest using the APEX data was gender and friendships. There is a measure that explores social network data through peer nomination to the question "Who do you hang out with the most and why". The question of interest here is whether there is a pattern in how many males identify females and vice versa. Furthermore, a more in depth investigation into the types of descriptions each gender has to offer for spending time with someone (of a specific gender) is the focus of my ongoing studies.

Previous literature suggests a qualitative difference in how women and men describe friendship, with women focusing more on emotional language and men giving more practical reasons for hanging out with someone (Wright & Scanlon, 1991, Rawlins, 1982).

Overall, the first study is nearly ready for statistical analysis (introduction and methods sections drafts complete) whereas the second study still needs to be worked on.

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Rawlins, W. K. (1982). Cross-sex friendship and the communicative management of sex-role expectations. Communication Quarterly, 30(4), 243-352.

Wright, P. H., & Scanlon, M. B. (1991). Gender role orientations and friendship: Some attenuation, but gender differences abound. Sex Roles, 24(9-10), 551-566.

SURF Abstract Submission & Post Program Survey 2020

Name   Olivia Pomeroy

Year of Graduation
                                  2022

SURF Advisor   Jackson, Benita; Psychology

SURF Field of Study   Psychology

Please list co-authors of your abstract (if applicable) Benita Jackson, Stephaney Perez, Uzma Malik, Emma Westgate, Alina A. I. Barylsky, Egypt Ballet, Abby Smith, & Isabel Schroedel

Title of Abstract/Research Translating Psychological Science to the Public: Re-framing "Rest" As Central to Social Change

Please type your abstract below.

The first half of 2020 was marked by a global pandemic and social and political upheaval. With the additional backdrop of the climate crisis, there is much need for coalition building to address the factors that divide social groups. And yet, it remains unclear the most effective and efficient ways to resource, grow, and connect needed social movements when there are so many possible actions to take. A first response might be to "do more!" But, following from research in the varied domains of health, cognitive function, productivity, organizational behavior, and sociology, we see that planned fallow periods are perhaps counter-intuitively what best cultivate physical, mental, behavioral, and societal well-being. Our team culled and vetted more than 100 audio talks, and for each talk, identified key persuasive passages and multiple accompanying academic research articles in a project to "give psychology away." Specifically, we gathered the raw materials needed to create an outward facing translational project of science for the greater public promoting the notion of "resting to rise." Erica Chenoweth, human rights and international affairs expert, has data in support of the "3.5% rule"- that it takes only a small portion of a population facing in the same direction to make non-violent change of its government. Our goals are, via message framing and repetition, to persuade listeners that the concept and practice of rest will not only confer benefits for their personal and collective well-being, but must be central to them. The work our team completed this summer builds a key foundation toward these ends.

SURF Abstract Submission & Post Program Survey 2020

Name

Perryne Vega

Year of Graduation

2022

SURF Advisor

Peckol, Paulette; Biological Sciences

SURF Field of Study

Marine Science

Please type your abstract below.

Due to COVID-19, Smith College was closed for the summer and students conducting SURF research needed to do so remotely. Our summer work included: 1) keeping a reflective journal that addressed questions and concerns that arose throughout the summer, 2) reading and discussing scholarly articles in the field of marine science on topics of habitat degradation and environmental justice. 3) designing and conducting short field studies as a group and individually, and 4) working independently in a growth/leadership area of our selection. We met for Zoom meetings twice per week to discuss our reflective journal response and scientific findings. Here, we detail some of our remote work.

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Though we were unable to conduct field/lab studies in marine science, this SURF experience provided us with many skills relevant to the field. While we considered the pervasive environmental racism embedded in many policies at national and international levels, we studied successful policies and brainstormed ideas for greater equity and involvement of all stakeholders. Finally, our independent projects enabled us to explore more individualized areas of interest that have enriched our Smith learning experience.

SURF Abstract Submission & Post Program Survey 2020

Name   Pratima Niroula

Year of Graduation   2023

SURF Advisor   Dorit, Robert; Biological Sciences

SURF Field of Study   Biological Science

Please list co-authors of your abstract (if applicable)   Hannah Snell, Serene Lee

Title of Abstract/Research   Can Data Save Us?

Please type your abstract below.

Pratima Niroula

The problem of antibiotic resistance is emerging as a major public health threat in the US. While we expect a clear relationship between antibiotic use and antibiotic resistance, demonstrating this link remains notoriously difficult. Using data garnered from multiple sources, including the CDC's Antibiotic Resistance Portal and the CMS Medicare Prescriber Data, we investigated the link between usage and resistance across geographic regions in the U.S. Employing a combination of data mining and analytic techniques (multiple regression, Machine Learning), we determined the relative importance of age structure, provider density, patient age, disease state and pathogen on the prevalence of antibiotic resistance. Our results suggest that frontline antibiotics are vastly overprescribed in relation to older, broad-range antibiotics, although this pattern varies from region to region. We are constructing a model to visualize the relationship between use and resistance that incorporates the relevant confounding variables. This model will be useful in predicting the rise of antibiotic resistance in the U.S., and should inform potential interventions that will address this important threat.

We investigated the relationship between antibiotic use and antibiotic resistance in the US, using longitudinal prescription and resistance data partitioned by geographic region. We are specifically interested in the variables that may confound the expected mechanistic link between the extent of antibiotic use and the prevalence of single or multiply-resistant bacterial strains. A predictive model incorporating the relative contribution of demographic, patient and prescribing variables (and their interactions) should help guide policy and prescription recommendations intended to mitigate this important public health threat.

SURF Abstract Submission & Post Program Survey 2020

Name   Quinton Celuzza

Year of Graduation   2021

SURF Advisor   Barresi, Michael; Biological Sciences

Secondary SURF Advisor   Rachel Wright

SURF Field of Study   Biological Sciences

Abstract of Research Results

Please list co-authors of your abstract (if applicable)   Lara Brown, Janeth Mora-Martinez, Elora Greiner, Sara Gutierrez

Title of Abstract/Research   Role of Bioelectric Patterning in Early Embryonic Development

Please type your abstract below.

Bioelectrics is the study of the patterns and effects of ion distribution (membrane potential) across an organism. Our lab group has been working to understand the role that bioelectrics plays in early axis determination using zebrafish (Danio rerio) as a model organism. We have previously examined bioelectric gradients using voltage-sensitive dyes, but we are currently working toward more stable methods to visualize patterns in membrane potential over longer periods of developmental time. To this end, we are working to develop lines of transgenic zebrafish expressing the genetically encoded voltage indicators. Furthermore, we have begun to characterize the effect of induced depolarization during gastrulation on gross embryonic morphology.

This summer, my efforts focused specifically on planning experiments to complete once I had access to campus resources again. My work was largely literature research, concept mapping, and experimental design.

SURF Abstract Submission & Post Program Survey 2020

Name   Rachael Newhall

Year of Graduation   2021

SURF Advisor   Williams, Steven; Biological Sciences

Secondary SURF Advisor   Jessica Grant

SURF Field of Study   Biochemisty

Abstract of Research Results

Title of Abstract/Research

Aedes polynesiensis Genome Project

Please type your abstract below.

The goal of the Aedes polynesiensis genome project was to sequence and annotate the unknown genome of the mosquito Aedes polynesiensis. This research is relevant to the world's population due to the increased spread of disease carrying mosquitoes because of elevated travel and trade. Relevant diseases are dengue, zika, yellow fever, and many more. An alarming issue is that the genetic makeup of these mosquitoes are changing rapidly as mosquitoes adapt to their new environments. New species, insecticide resistance, and genetic variations make it difficult for vaccines or other treatments to be found. By sequencing the unknown genome of Aedes polynesiensis, we can help the greater scientific community find specific genes that can inhibit the spread of these diseases. The steps we took were genome assembly, automatic assembly, and manual annotation. The initial genome assembly used data output from Illumina, Nanopore, and PacBio, which then were used to create a rough estimate of what the genome could be by using software programs DBG2OLC and ABySS. The next step was to take the predicted genome and compare it to similar species such as Aedes albopictus using programs MAKER and BUSCO. While potential hits were seen, we did not see proteins that should be in the genome and are very common in mosquitoes suggesting that our genome assembly is not complete. The next step was to manually annotate genes by comparing our genome to related species genes using the NCBI BLAST database. Genes we searched for were sex-determining, salivary, odorant, and insecticide resistance genes. We identified some genes that yielded promising protein sequences, however for more complete results we will be carrying this project into the Fall of 2020. We hope to improve genome quality, obtain RNAseq data, and complete more manual annotations.

SURF Abstract Submission & Post Program Survey 2020

Name   Rachel Pietrow

Year of Graduation   2022

SURF Advisor
                                                                    Williams, Steven; Biological Sciences

Secondary SURF Advisor   Jessica Grant

SURF Field of Study   Bioinformatics

Abstract of Research Results

Title of Abstract/Research   Aedes polynesiensis Genome Assembly and Annotation

Please type your abstract below.

Female Aedes polynesiensis mosquitoes act as vectors of both viral pathogens, such as dengue and Ross River virus, and filarial pathogens, including Wuchereria bancrofti. During a mosquito's blood meal the virus or parasite is transmitted into the bloodstream, infecting the vertebrate host. Novel control strategies are needed to combat the mosquito's ability to spread these dangerous pathogens. The goal of our project this summer was to assemble and annotate the genome of Aedes polynesiensis and consequently understand more about mosquito biology and potential strategies that could be used to combat the spread of disease.

To assemble the genome, we used sequencing data from both second and third generation sequencing technology gathered by masters student Renna Bushko. We utilized the hybrid assembly programs ABySS and DBG2OLC and completed several runs in order to identify the optimal parameters. As we moved forward in the project, it became clear that there were large gaps in our assembly and we decided to continue on using only the output from ABySS. We plan to revisit both the issue of the DBG2OLC output and an unsuccessful run of a different assembly program, MaSURCa, in the fall. We then ran an automatic annotation pipeline, MAKER, on the draft assembly. MAKER is an iterative process designed to predict genes and identify repeats within the assembly. We also manually annotated the genome and were able to identify coding sequences of salivary gland, sex determining and odorant binding genes, as well as genes related to insecticide resistance. I focused on locating the coding regions of various salivary gland genes within our draft assembly using the programs BLAST, SeaView, and MegAlign. While this process was both time consuming and full of setbacks, it was also incredibly rewarding to identify significant proteins within our genome.

This fall we hope to troubleshoot the issues with our draft genome assembly and acquire RNAseq data from Aedes polynesiensis to improve our annotation. I'm particularly interested in continuing to characterize the salivary gland genes of the mosquito. Since these crucial proteins are involved in the blood feeding of mosquitoes, they are the key to understanding vector competence and potentially developing novel disease control strategies.

SURF Abstract Submission & Post Program Survey 2020

Name   Raven Wang

Year of Graduation
                                            2023

SURF Advisor   Tymoczko, Julianna; Mathematics and Statistics

SURF Field of Study   Mathematics

Please list co-authors of your abstract (if applicable)   Zhong Zhang, Kevin Zhu

Title of Abstract/Research   Investigating splines on triangulations in plane

Please type your abstract below.

A spline is a special type of function that labels vertices of a graph such that if two vertices are joined by an edge with a label, then the edge label will divide the difference between the labels of vertices. In our work, we worked towards the general goal of finding the dimension of degree-2 splines. We focused on splines on triangulations, a type of graph that consists of triangles, and their dual graphs. With both empirical approaches and theoretical approaches, we studied the discrete properties of these graphs and how these properties influence the dimension.

Specifically, we used CoCalc codes designed by others to generate a basis of degree-2 splines. Through trials, we believed there is a misleading result within CoCalc codes (it sometimes provides redundant elements in the result). Our team member, Kevin, developed a Python-based cleaner program to eliminate these redundant dimensions. Given an upper limit on dimensions, the program produces polynomial ideals of elements in the generating set given by CoCalc codes, before concatenating the ideals of different vertices to produce an eigen-ideal of the entire graph. It then checks whether the new element in the spline space basis could be interpreted as linear combinations of elements in previous ideals. In addition, Kevin also provided a solution for generating random triangulations and its related parameters to be input into CoCalc, for the convenience of further studies.

For the theoretical part, we constructed proofs regarding basic properties of splines over triangulations. We came up with two prospective ways of finding the minimal generating set of degree-2 splines on triangulations. For the first one, we started out from degree-0 and degree-1 splines. Then, we studied the possible degree-2 splines in the minimal generating set. We did this in a way similar to Gaussian Elimination. We looked at the contribution to the total dimension made by labels of vertices that are distance 1 from the vertices reduced to zero. Through induction, we can find out all degree-2 splines that are in the minimal generating set. Some steps of this algorithm need to be further justified. The second prospective method of finding the dimension is by cutting the graphs into pieces and studying their dimensions respectively. Then, we join them together with some conditions. In future studies, we will continue working on improvements and theoretical proofs of these procedures, hoping to prove the Strang's lower-bound conjectures.

SURF Abstract Submission & Post Program Survey 2020

Name   Rose Evard

Year of Graduation   2023

SURF Advisor   Witkowski, Sarah; Exercise and Sport Studies

SURF Field of Study   Exercise and Sports Studies

Title of Abstract/Research   Physical Activity and Hot Flashes

Please type your abstract below.

Menopause, defined as the cessation of menstrual cycles, occurs in women 40-60 years old. Hot flashes (HFs) are defined by sudden sensations of heat throughout the body, increased sweating and heart rate, and flushing of the face and neck. Eighty percent of women experience HFs during menopause, which persist for an average of 8 years. HFs can cause discomfort, disruption, and decreased quality of life. While there are medical interventions known to decrease HFs, many have unwanted side effects. Physical activity (PA) is anecdotally claimed to reduce HFs, but past scientific reviews of the still-emerging field have concluded that there is not enough data to fully determine if there is such a relationship.

My SURF work had two aims on two projects relating to PA and HFs. 1) To work on the development and deployment of an online questionnaire for women around the menopause transition to assess relationships between PA and their experiences of menopause. 2) To review recently published literature within the field of PA and HFs, draft an outline, and begin to write an updated review on the subject and our findings.

Our questionnaire aims to longitudinally track women across the menopause transition to determine whether lifestyle (particularly PA) correlates with common menopausal experiences. In regard to project development, we researched Qualtrics tools to carry out the aims of the study. We created and updated Standard Operating Procedures for participant recruitment and interaction, data management, and questionnaire distribution. We have begun to update our IRB protocols to submit for review and plan to continue the work into the school year.

In relation to the second aim of my SURF project, we searched PubMed for original research using a search term relating to HFs (e.g. Hot flashes, menopause, vasomotor symptoms) along with PA terminology (e.g. physical activity, exercise). I categorized relevant papers by their methods then analyzed them. I began drafting and editing the manuscript. In our manuscript, we plan to discuss novel aspects of the relation between HFs and PA that were unexamined in past reviews including, illuminating the differences of objectively measured HFs to self-reported experiences and presenting data suggesting that HFs are not induced by an increase in core temperature. My plan is to complete the manuscript through the fall semester as my work in the Witkowski Lab, eventually submitting it into a menopause health journal for review.

SURF Abstract Submission & Post Program Survey 2020

Name

Rukaiya Abdullah

Year of Graduation

2023

SURF Advisor

Scordilis, Stylianos; Biological Sciences

If your SURF Advisor was not listed above you can enter their name here.

Rukaiya Abdullah

SURF Field of Study

Biology and biochemistry

Title of Abstract/Research   RUKAIYA ABDULLAH - 2020 REMOTE SURF

Please type your abstract below.

Having to do research remotely is one of the most challenging things to do especially in these unprecedented times. The most important highlight of 2020 SURF was reading and discussing research papers, which is the most plausible thing one can do when the immunoblots I was to analyze couldn't be produced in a timely fashion. I read papers that focused on biochemical research and the application of biochemical and proteomic techniques such as immunoblotting in identifying and solving problems.

In the recent paper from our lab, Russ, D., Dimova, K., Morris, E., Pacheco, M., Garvey, S. M. and S. P. Scordilis. Dietary Fish Oil Supplement Induces Age-Specific Contractile and Proteomic Responses in Muscles of Male Rats. Lipids in Health and Disease, 19: 165-177, DOI: 10.1186/s12944-020-01333-4, 2020, two-dimensional gel electrophoresis and quantitative immunoblotting were employed to investigate the medial gastrocnemius muscle. My project was to have been the analysis of immunoblots validating the proteomics results.

Some as yet unpublished results in the medial gastrocnemius muscle using a cutting-edge semi-quantitative proteomics technique, tandem mass tagging, show significant changes in myosin proteoforms. In depth reading of Trivedi, D., Nag, S., Spudich, A., Ruppel, K. M. and James A. Spudich. The Myosin Family of Mechanoenzymes: From Mechanisms to Therapeutic Approaches. Ann Rev Biochem, 89: 667-693, 2020, yielded a fundamental understanding of the structure and functions of many mammalian myosin proteoforms, as well as their involvement in diseases and their potential uses in therapeutic approaches. I encountered a completely new way of thinking about the myriad of myosins and their relationship to medicine and therapy.

Lastly, in our weekly lab meetings depth immunoblotting was discussed as a validation technique for proteomic results that helps in the quantitative analysis of proteins. In this phase, I learned more about antigens and antibodies and how the specificity and functionality of each set of enzymes is important for substrate detection, something I was interested in from Bio 132.
In a nutshell, this summer experience gave me a more theoretical understanding of research techniques and research papers and how important they are to research itself and to therapy and medicine. It also gave me more insight into the execution of protocols in actual research and how precise one must be to use them properly. I enjoyed learning more during this time and I am hopeful that in the near future, I'll get into the lab and practically apply what I've learned.

SURF Abstract Submission & Post Program Survey 2020

Name

Sara Halili

Year of Graduation

2022

SURF Advisor

Williams, Steven; Biological Sciences

SURF Field of Study

Biology: Genomics

Title of Abstract/Research   Assembly and elucidation of Aedes polynesiensis genome

Please type your abstract below.

During the summer of 2020, I participated in a group genomics project aimed at assembling and annotating the genome of Aedes polynesiensis, an important vector for lymphatic filariasis, dengue, and Ross-river virus. We used Nanopore, PacBio, and Illumina sequencing data collected by Renna Bushko for the hybrid assembly of the genome. During this process, I became familiar with several bioinformatics programs such as ABySS, DBG2OLC, MaSuRCA and the programming language Python. In the meantime, I delved deeply into the literature of disease vector mosquitoes, especially the Aedes species.
 While the team was working on the automatic annotation of the genome by downloading different software needed for MAKER annotation pipeline to run, we also started the tedious yet interesting process of the manual annotation of the genome. I focused on finding the coding sequences of sex-determining genes and odorant genes mainly from Aedes albopictus species in the Aedes polynesiensis genome by using the BLAST, SeaView, and MegAlign. At this step, we realized that there was an issue with our hybrid assembly, which we hope to address next semester. While my experience with summer was highly productive, manual annotation of a genome is an arduous task that cannot be completed within a few weeks worth of work.
My goal this fall is to utilize comparative genetics and rigorous research done on two similar species, Aedes albopictus and Aedes aegypti, to investigate and identify genes of high importance in regard to vector competence in Aedes polynesiensis. I particularly hope to focus on the chemosensory gene family and more specifically odorant binding and receptor proteins, which have been shown to guide host-seeking—and thus biting behavior—as well as mosquito oviposition. Upon finalization of the manual annotation and automatic gene discovery, which we hope to improve by the incorporation of RNA sequencing data, I hope to complete a thorough characterization of the odorant gene repertoire of Aedes polynesiensis.

SURF Abstract Submission & Post Program Survey 2020

Name

Sarah Bingham

Year of Graduation

2022

SURF Advisor

Garcia, Randi; Psychology

SURF Field of Study

Psychology

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

Title of Abstract/Research   Daily Social Media Use and Self-Objectification and Well-Being AND Teleworking Households and Divison of Labor During Covid AND Disordered Eating Behaviors and Visual Social Media Use

Please type your abstract below.

As a continuation of our lab from Spring 2019, our lab stopped work due to Covid-19 on a previous project that was designed to study the division of labor among cohabitating couples of all genders and sexual orientations. Instead, we shifted our focus to the impact that Covid had on households where one person was teleworking. We redesigned our study from in-person measures with an initial assessment and daily diaries to an online only initial assessment and daily diaries study. We completed design of this study and received IRB approval to launch. We completed our work on the study with the next phase being set for launch using Qualtrics, specifically that the next phase will take place for the next lab in Fall 2020.

Further, I completed co-authoring a publication with Randi Garcia, which we completed and submitted for publication at Psych of Women Quarterly. We are awaiting a revise and resubmit.

Lastly, I began work on my thesis project, doing literature review and finding measures. My thesis project aims to study the effects of visual social media use such as Instagram on disordered eating behaviors like body checking.

SURF Abstract Submission & Post Program Survey 2020

Name

Sarah Seron

Year of Graduation

2020

SURF Advisor

Witkowski, Sarah; Exercise and Sport Studies

SURF Field of Study

Exercise and Sport Studies

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

Title of Abstract/Research   Improving Evaluation of Endothelial Microparticles with Imaging Flow Cytometry: A Novel Look at Subclinical Cardiovascular Disease in Women

Please type your abstract below.

Cardiovascular disease (CVD) is one of the leading causes of death of women in the United States (1). The risk of CVD increases dramatically during the midlife years around the transition to menopause due to changes in traditional risk factors for CVD (2). Regular physical activity is known to have beneficial effects on CVD risk in general, but a clearer understanding of CVD risk and the factors that contribute to CVD risk in women can help us understand the effect of physical activity and exercise in midlife women.

Past studies have implemented traditional measures of CVD risk such as cholesterol and blood pressure, which do not fully measure the risk in midlife women (3). As a result, the prediction of heart disease in women may be underestimated (4,5). Therefore, we need to improve our understanding of CVD risk factors in women. This can be achieved by improving knowledge on female-specific conditions that change CVD risk and discovering novel methods that can help improve the estimation of risk in women.

The endothelium is the layer of cells that form the inner lining, acting as a barrier, of the blood vessels, heart, and lymphatic vessels (3,4). Endothelial dysfunction precedes the development of CVD (6). The transition to menopause is known to reduce endothelial function with advancing menopausal stage in healthy women independent of aging (2,7).

Endothelial microparticles (EMP) are small fragments of the endothelium shed into the bloodstream that hold important information regarding acute status of the endothelium. Given that they are derived from parent endothelial cell membranes, they contain the markers of the parent cells. Two EMP cell populations that are specific biomarkers of endothelial cell status are CD62E (activated) and CD31+/42b- (apoptotic) EMP's (3). Endothelial cell activation is an indicator that the cell has undergone a stress such as mechanical injury due to factors circulating in the blood or changes in blood flow patterns. Endothelial cells, and therefore EMPs from those cells, express the surface marker CD62E. Similarly, endothelial cell apoptosis is indicative of cellular death in the endothelium, often caused by increased stress in the vessels (2). A variety of stimuli can cause changes in endothelial cells, and therefore their EMPs. EMPs then circulate through the bloodstream where they can be sampled and assessed.

Previously, two studies conducted in Dr. Witkowski's lab assessed EMPs with traditional flow cytometry (2,8). The first study evaluated low-active peri- and postmenopausal women. This study showed that circulating CD62E+ (activated) EMP were higher in post- compared with perimenopausal women at rest, but only increased in perimenopausal women in response to acute moderate exercise. The study also showed that CD31+/42b- (apoptotic) EMP's were similar in peri- and postmenopausal women at rest but decreased in peri- and increased in postmenopausal with acute exercise such that postmenopausal

women had higher CD31+/42b- EMP after exercise (8). In the second study, acute exercise reduced CD62E+ and CD32+/42b-in healthy women 40-65 years old.3 Others have shown no difference in CD62E+ or CD31+/42b- EMPs in African American pre- and postmenopausal women of a similar age (9). Interpretation of these studies and others in the literature is complicated by a lack of consistent and validated protocols for flow cytometric analysis of EMPs.

While methods of analyzing small particles like EMP's have been improved, many problems still exist. The most common of these problems with traditional flow cytometry are false positives and false negatives due to a lack of the tool's sensitivity. Traditional flow cytometry struggles with clearly identifying individual particles, often misreading multiple particles as a single event (10). Imaging flow cytometry (IFC) is a tool that can reduce the known problems with quantifying labeled cells and particles with traditional methods by imaging each particle individually. Developing an easily replicated protocol for IFC has the potential to decrease the errors in the current methods (10).

This summer, we advanced our knowledge in what is currently in the literature about the relationship between EMPs, physical activity, and midlife women. We analyzed and compared demographics, exercise types, methods, and results from previous studies. Next, we compiled protocols used in previous studies to measure EMPs for both traditional flow cytometry and IFC. In the fall, we will use our knowledge to prepare and run samples on both a traditional flow cytometer and an imaging flow cytometer. We will statistically analyze and use the data to optimize a novel technique to evaluate endothelial status through measurement of Endothelial Microparticles (EMP) in midlife women. Improvement of the method to quantify CD62E+ and CD31+/42b- EMP's with IFC will directly contribute to our studies in Dr. Witkowski's lab to evaluate endothelial cell status, function and CVD risk in women. This work will also help us achieve our goal to determine the role of physical activity and exercise to change CVD risk in women undergoing the transition to menopause.

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SURF Abstract Submission & Post Program Survey 2020

Name   Sasha Yeutseyeva

Year of Graduation
                                            2023

SURF Advisor   Kinnaird, Katherine; Computer Science

SURF Field of Study   Computer Science

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

Upload image(s) in .png format; 1,100 MB max size each
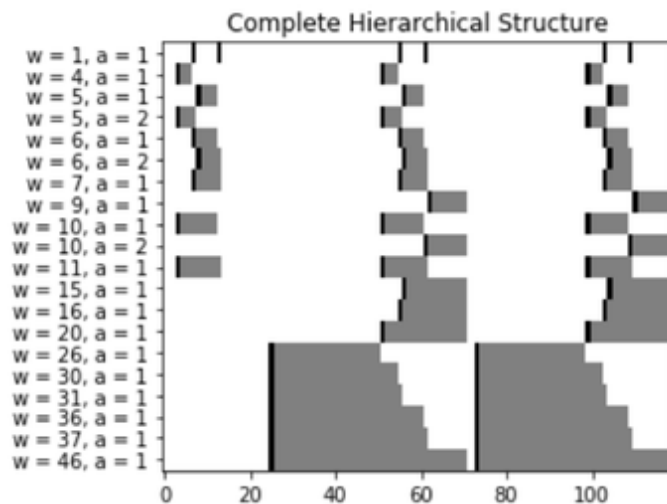
Title of Abstract/Research   Aligned Hierarchies

Please type your abstract below.

Music often has repeated elements that build on each other, creating hierarchies. Extracting these repetitions and their relationships to each other is the goal of the python package AH. This package creates aligned-hierarchies of music based data streams through finding and encoding repeated structures, and is based on Katherine M. Kinnaird's thesis Aligned Hierarchies for Sequential Data and the accompanying MATLAB code. This summer, we completed, improved on, and successfully debugged the package started last summer, by cross-referencing the desired output of the package with the output of the MATLAB code. Additionally, we created Jupyter notebook files that act as a guide through the package, including summarizing each individual function. There is a separate notebook file for each module, as well as an overarching file highlighting the code from start to finish. Moreover, we also created test files for each module to make sure the functions work as we desired. Future steps for this project include writing and submitting a paper outlining this code to the Journal of Open Source Software as well as further developing the package to include aligned sub-hierarchies, which are derivatives of aligned hierarchies and a structure-based approach to the cover song task.

SURF Abstract Submission & Post Program Survey 2020

Name   Stephaney Perez

Year of Graduation
                                      2023

SURF Advisor   Jackson, Benita; Psychology

SURF Field of Study   Psychology

Please list co-authors of your abstract (if applicable)   Benita Jackson, Olivia Pomeroy, Stephaney Perez, Uzma Malik, Emma Westgate, Alina A. I. Barylsky, Egypt Ballet, Abby Smith, & Isabel Schroedel

Title of Abstract/Research   Translating Psychological Science to the Public: Re-framing "Rest" As Central to Social Change

Please type your abstract below.

The first half of 2020 was marked by a global pandemic and social and political upheaval. With the additional backdrop of the climate crisis, there is much need for coalition building to address the factors that divide social groups. And yet, it remains unclear the most effective and efficient ways to resource, grow, and connect needed social movements when there are so many possible actions to take. A first response might be to "do more!" But, following from research in the varied domains of health, cognitive function, productivity, organizational behavior, and sociology, we see that planned fallow periods are perhaps counter-intuitively what best cultivate physical, mental, behavioral, and societal well-being. Our team culled and vetted more than 100 audio talks, and for each talk, identified key persuasive passages and multiple accompanying academic research articles in a project to "give psychology away." Specifically, we gathered the raw materials needed to create an outward facing translational project of science for the greater public promoting the notion of "resting to rise." Erica Chenoweth, human rights and international affairs expert, has data in support of the "3.5% rule"- that it takes only a small portion of a population facing in the same direction to make non-violent change of its government. Our goals are, via message framing and repetition, to persuade listeners that the concept and practice of rest will not only confer benefits for their personal and collective well-being, but must be central to them. The work our team completed this summer builds a key foundation toward these ends.

SURF Abstract Submission & Post Program Survey 2020

Name   Uzma Malik

Year of Graduation
                                           2022

SURF Advisor   Jackson, Benita; Psychology

SURF Field of Study   Psychology

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

Benita Jackson, Olivia Pomeroy, Stephaney Perez, Uzma Malik, Emma Westgate, Alina A. I. Barylsky, Egypt Ballet, Abby Smith, & Isabel Schroedel

Title of Abstract/Research

Translating Psychological Science to the Public: Re-framing "Rest" As Central to Social Change

Please type your abstract below.

The first half of 2020 was marked by a global pandemic and social and political upheaval. With the additional backdrop of the climate crisis, there is much need for coalition building to address the factors that divide social groups. And yet, it remains unclear the most effective and efficient ways to resource, grow, and connect needed social movements when there are so many possible actions to take. A first response might be to "do more!" But, following from research in the varied domains of health, cognitive function, productivity, organizational behavior, and sociology, we see that planned fallow periods are perhaps counter-intuitively what best cultivate physical, mental, behavioral, and societal well-being. Our team culled and vetted more than 100 audio talks, and for each talk, identified key persuasive passages and multiple accompanying academic research articles in a project to "give psychology away." Specifically, we gathered the raw materials needed to create an outward facing translational project of science for the greater public promoting the notion of "resting to rise." Erica Chenoweth, human rights and international affairs expert, has data in support of the "3.5% rule"- that it takes only a small portion of a population facing in the same direction to make non-violent change of its government. Our goals are, via message framing and repetition, to persuade listeners that the concept and practice of rest will not only confer benefits for their personal and collective well-being, but must be central to them. The work our team completed this summer builds a key foundation toward these ends.

SURF Abstract Submission & Post Program Survey 2020

Name   Val Farley

Year of Graduation   2023

SURF Advisor
                                  Immerman, Gaby; Biological Sciences;

Secondary SURF Advisor   Sarah Loomis

SURF Field of Study   Biology, Botany, Evolution

Abstract of Research Results

Title of Abstract/Research   Sharing Plant Evolution with the General Public

Please type your abstract below.

Communicating scientific information to the general public is an important and necessary task for scientists. In order for the general public to learn about and appreciate the questions asked and information presented by scientific research these things need to be broadly accessible. From there the focus can shift to presenting the information in an engaging way. There are three important questions regarding this. First, what information is most important to convey? Second, how would one present this information in an accessible way? Lastly, why is this information important to share? At Smith, campus gardens, arboretum, and Lyman Plant House are all features that attract visitors, with unique and interesting plants that fit into the larger puzzle of evolution. The Systematics Garden already does an excellent job highlighting these evolutionary relationships in an accessible way, however this garden focuses on angiosperms, and the evolutionary history of plants extends much further back in time. Lyman Plant House also features some beautiful murals that depict various stages in plant evolution.

In February of 2020 I proposed to create an all-encompassing tour of plant evolution featuring plants on campus to further open this field of study to visitors in the general public. The initial plan was for this tour to use the Cuseum app, and include brochures and/or signage.

Over the summer of 2020 I selected plants for the tour to act as an ambassador to visitors on behalf of the period of evolutionary history in which they emerged. Along with each plant I included a photo and a description of the plant, as well as a description of common themes and traits that emerged around the time featured plants became their own species to provide context. I also selected plants to show off particularly interesting or unique adaptations to further encourage interest in plant life, and compiled this information into signage and a brochure. I utilized QR codes to connect these features to more information that could not fit on brochures and signs until the Cuseum app is available for use at Smith.
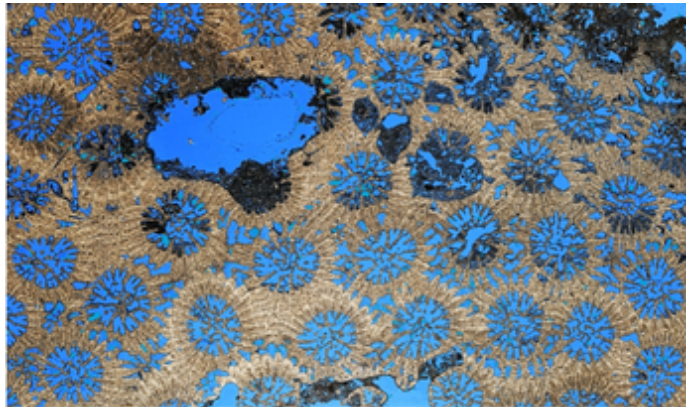
The tour designed in this project will be implemented by the Botanic Garden, and information will be transferred to the Cuseum app, to guide visitors through the history of plant evolution and potentially introduce them to some interesting plants they may not have heard of or seen before.

SURF Abstract Submission & Post Program Survey 2020

Name

Victoire Raissa Mugabekazi

Year of Graduation

2021

SURF Advisor

Glumac, Bosiljka; Geosciences;

SURF Field of Study

Geosciences

Please list co-authors of your abstract (if applicable)   George Pharris, and Kristine Lu

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

Title of Abstract/Research   Impact of storms, sea-level fluctuations and climate changes on modern and Pleistocene environments of San Salvador Island, Bahamas

Please type your abstract below.

Using samples and data collected during the GEO 334 Carbonate Sedimentology January 2020 trip to San Salvador Island, Bahamas, and the following Spring 2020 course, we undertook two remote research projects this summer: 1) analysis of a core through a Pleistocene coral reef; and 2) evaluation of the impact of storms on two coastal sites on San Salvador. The first project focused on carbonate deposits from a 34 m deep core formed during the last interglacial period, ~125,000 years ago, when sea level was ~6 meters higher than present. These deposits provide important insights into the makeup and health of coral reefs in times of warm climate and high sea levels. Our research aims at documenting the distribution and impact of thick algal and microbial encrusters on corals within this fossil reef. Such encrusters can fill pore space in the reefal framework, altering porosity and permeability of these rocks and modifying their fluid storing and transporting properties. We investigated selected core samples using a variety of methods. Last spring we collected GeoTek density measurements along with iTrax core scanner radiographs and X-ray fluorescence (XRF) elemental data at the University of Massachusetts, Amherst. We also sent samples to the Special Core Analysis Laboratory in Texas for permeability, porosity and grain density measurements and CT scanning. During the summer, we worked on determining the porosity of core samples using point counting and Fiji image analysis software on high resolution scans of petrographic thin sections (Figure 1). Additionally, we used RediCore software to relate optical and radiographic images of the core to elemental data. Integration of the results of these various analyses forms the base for a comprehensive comparative study of different rock types represented in the core.

For the second project we analyzed the data collected in the field by using drone and RFID (radio frequency identification) technologies to track movement of large rock boulders by storm waves. Specifically, we compared drone images from 2020 to those acquired in 2016 and 2017 after Hurricane Joaquin made a landfall on the island in October 2015. We also compared photographs and information about location of boulders tagged using RFID between June 2019 and January 2020 to document their movement by waves in the absence of major hurricanes. We used ArcMap to pin the location of tagged boulders and to create digital elevation maps and transects utilizing data from the drone for comparison with transects measured manually in 2012. This work further highlights the impact of storms on low elevation coastlines of small tropical islands and provides a robust database for future comparative analyses within this long-term monitoring study. We will be presenting the results of this work as two

posters at the Geological Society of America (GSA) Online Gathering in October 2020.

SURF Abstract Submission & Post Program Survey 2020

Name   Wayne Ndlovu

Year of Graduation   2022

SURF Advisor   Rhodes, Amy; Geosciences

SURF Field of Study   Geosciences

Title of Abstract/Research   Assessing road salt impacts on wetland groundwater and soil geochemistry

Please type your abstract below.

De-icing salt (NaCl) applied to roads can elevate Na^+ and Cl^- concentrations in nearby soils and water bodies through surface runoff and groundwater recharge. Peatlands and wetlands adjacent to these roads retain this salt. Major ion chemistry data were collected to interpret which wetlands have regional sources of ground and surface water (as expected for fens and marshes, but not bogs), and therefore greater potential for receiving regional road salt contamination. Different wetlands types were selected based on examining a GIS datalayer of MassDEP Wetlands and noting their proximity to different roadways. Wetlands located next to minor roads included Arcadia Bog (AB), Mill Valley Road Bog (MVRB), and a vernal pool and a bog (AB Vernal Pool and AB Moat) located adjacent to one another; these four wetlands are located in Belchertown. Wetlands located near state highways included East Templeton Pond (ETP) and Trout Brook Wetland (TBW), both of Templeton, and Quag Bog (QB) of Gardiner. A wetland at Fitzgerald Lake (FL) of Northampton is located near heavily trafficked local roads and downstream of the US Veterans Medical Center and Northampton VA Medical Center. Waters and soils from these wetlands were sampled and analyzed in 2019. Based on field observations of vegetation, whether peat or organic mud was present, and ANC and pH results, these wetlands were grouped into bogs (MVRB, AB, AB Moat and TBW), a vernal pool (AB Vernal Pool), a fen (QB), and fresh water marshes (FL and ETP). Overall, Cl^- concentrations are higher in wetlands located next to state highways: there are higher application rates of NaCl on these roads. Cl^- is lower in bogs and the vernal pool, but still suggests evidence of some road salt contamination (40 µmol L-1 - 501 µmol L-1). Cl^- concentrations are even higher in the fens and marshes (1081 µmol L-1 - 11620 µmol L-1). Sites classified as freshwater marshes have higher Cl^- concentrations toward the center of the wetland. In contrast at MVRB and QB, Cl^- and ANC concentrations are higher in their moats by 7.5% (MVRB) and 38.2% (QB) than in ground and surface water located toward the center of the wetland. The elevated ANC suggests that the moats of these wetlands receive relatively higher regional groundwater that could also be a source of road salt. At MVRB, however, low Cl and negative ANC values toward the center suggest that the interior of this bog is not hydraulically connected to the moat. Although cation analysis has not yet been completed, there is evidence that wetlands closer to major state highways have higher Cl^- concentrations. We predict that the Na^+ concentrations will follow a similar pattern. Overall, we also expect the bogs and vernal pool to have the lowest Na^+ and Cl^- concentrations when compared to the fen and freshwater marshes.

SURF Abstract Submission & Post Program Survey 2020

Name   Wumei Blanche

Year of Graduation
                                            2022

SURF Advisor   Torquato, Samantha; Biological Sciences

SURF Field of Study   Sea Turtle Parasite Genomics

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

Title of Abstract/Research   The Identification of Eight Unknown Sea Turtle Parasites through Whole-genome Sequencing

Please type your abstract below.

Nearly all species of marine turtles have been classified as endangered due to climate change and overfishing. As global sea temperatures increase, the prevalence and severity of aquatic parasites are also projected to increase, thereby further threatening the biodiversity of marine turtle populations. Green (Chelonia mydas) and loggerhead sea turtles (Caretta caretta) of the Mediterranean Sea are two species of marine turtles that are negatively impacted by warming waters and parasitic infections. The accurate identification of the parasites infecting these sea turtles will allow us to better assess emerging infectious disease threats to them in the wild and to better treat their parasitic infections. In this study, we used whole-genome sequencing to identify the species of eight unknown parasite samples that were received from four sea turtle rescue centers along the Adriatic coast.

Previously, members of the laboratory extracted DNA from the eight parasite samples and conducted paired-end, whole-genome sequencing on the Illumina MiSeq. The sequencing data for each sample was retrieved from Illumina's BaseSpace Sequence Hub, and the overall quality of the data was checked using the Galaxy RepeatExplorer2 server. Potential COX1, SSU, and ITS2 gene sequences for marine parasite species were retrieved from the NCBI database in order to be used as reference sequences for our sample analyses. Then, the paired-end sequencing data for each sample were run through DNASTAR NGen to perform de novo assembly of each sample's genome. A computer-based nBLAST between each sample's de novo assembled genome and each reference gene was performed in order to determine each sample's final SSU, ITS2, and COX1 gene sequences. Each sample's identified SSU, ITS2, and COX1 sequences were analyzed through the online NCBI database's BLASTn feature in order to determine the sample's most likely species. Lastly, we performed an SRA-BLASTn to confirm that the determined gene sequences were not contaminated with sea turtle DNA. Based on our results, we concluded that our eight samples could be identified as one of the following parasite species: Ozobranchus margoi (a marine turtle leech), Sulcascaris sulcata (a gastric nematode parasite of sea turtles), or Emplectonema gracile (a free-living, green ribbon worm).

SURF Abstract Submission & Post Program Survey 2020

Name   Xiaowen Zong

Year of Graduation   2023

SURF Advisor   Howe, Nicholas; Computer Science

SURF Field of Study   Computer Science

Title of Abstract/Research   Handwritten Syriac Text Recognition

Please type your abstract below.

Offline Handwritten Text Recognition (HTR) systems transcribe text contained in scanned images into digital text. We want to use this system to convert scanned Syriac documents into Syriac transcripts. The previous project utilized Harald Scheidl's HTR system [1], which depended on TensorFlow, and contained 5 CNN layers, 2 RNN layers, and a CTC decoding layer. This former system was trained with approximately 2000 word images from the Ceriani Veteris Genesis document. However, it only did word-based recognition, and the output was limited to 32 characters. Also I found that the training, testing, and validation sets were not correctly separated in the previous approach. The system was tested on what it was trained on, so the output is not reliable.

In summer 2020, I worked to enhance the previous system. I increased CNN from 5 to 7 layers for a more accurate recognition; I increased input size from 128*32 to 800*64 for a line-based HTR, and I increased output size from 32 characters to 100 characters. Some other features were changed accordingly. I also expanded data size from approximately 500 lines to 17390 lines. And after properly separating training, testing, and validation set, I get 90 present accuracy rates for line-based recognition. This accuracy rate varies for different Syriac fonts, so further testing is needed for a more reliable result.

To improve accuracy, I tried different models. Jonathan Chung and Thomas Delteil's HTR [2] is another system that we examined. I worked to set up this system, and tried to use it on Syriac data. Even though a full-page HTR is appealing, the data it worked with originally formatted differently compared to our data. Therefore, more work needs to be done. Due to time limitations, this system's features are not fully tested, so it is still worth constructing further research, which would hopefully achieve our initial goal.

Scheidl, H. (2020, August 09). Build a Handwritten Text Recognition System using TensorFlow. Retrieved August 27, 2020, from https://towardsdatascience.com/build-a-handwritten-text-recognition-system-using-tensorflow-2326a3487cd5

Chung, J., & Delteil, T. (2019). A Computationally Efficient Pipeline Approach to Full Page Offline Handwritten Text Recognition. 2019 International Conference on Document Analysis and Recognition Workshops (ICDARW). doi:10.1109/icdarw.2019.40078

SURF Abstract Submission & Post Program Survey 2020

Name   Zhong Zhang

Year of Graduation   2023

SURF Advisor   Tymoczko, Julianna; Mathematics and Statistics

SURF Field of Study   Mathematics

Please list co-authors of your abstract (if applicable)   Kevin Zhu, Raven Wang

Title of Abstract/Research   Investigating Degree-2 Splines on Triangulations in Plane

Please type your abstract below.

A spline is a special type of function that labels vertices of a graph such that if two vertices are joined by an edge with a label, then the edge label will divide the difference between the labels of vertices. In our work, we worked towards the general goal of finding the dimension of degree-2 splines. We focused on splines on triangulations, a type of graph that consists of triangles, and their dual graphs. With both empirical approaches and theoretical approaches, we studied the discrete properties of these graphs and how these properties influence the dimension.

Specifically, we used CoCalc codes designed by others to generate a basis of degree-2 splines. Through trials, we believed there is a misleading result within CoCalc codes (it sometimes provides redundant elements in the result). Our team member, Kevin, developed a Python-based cleaner program to eliminate these redundant dimensions. Given an upper limit on dimensions, the program produces polynomial ideals of elements in the generating set given by CoCalc codes, before concatenating the ideals of different vertices to produce an eigen-ideal of the entire graph. It then checks whether the new element in the spline space basis could be interpreted as linear combinations of elements in previous ideals. In addition, Kevin also provided a solution for generating random triangulations and its related parameters to be input into CoCalc, for the convenience of further studies.

For the theoretical part, we constructed proofs regarding basic properties of splines over triangulations. We came up with two prospective ways of finding the minimal generating set of degree-2 splines on triangulations. For the first one, we started out from degree-0 and degree-1 splines. Then, we studied the possible degree-2 splines in the minimal generating set. We did this in a way similar to Gaussian Elimination. We looked at the contribution to the total dimension made by labels of vertices that are distance 1 from the vertices reduced to zero. Through induction, we can find out all degree-2 splines that are in the minimal generating set. Some steps of this algorithm need to be further justified. The second prospective method of finding the dimension is by cutting the graphs into pieces and studying their dimensions respectively. Then, we join them together with some conditions. In future studies, we will continue working on improvements and theoretical proofs of these procedures, hoping to prove the Strang's lower-bound conjectures.

SURF Abstract Submission & Post Program Survey 2020

Name   Zoe Baker

Year of Graduation   2023

SURF Advisor   Hayssen, Virginia; Biological Sciences

SURF Field of Study   Biological sciences

Title of Abstract/Research   Exploring the Female Perspective Within the Biological
                                       Sciences

Please type your abstract below.

The female perspective has oft been ignored by researchers within the biological sciences (Hayssen & Orr, 2017). When analyzing the language and investigative frameworks relied upon within scientific literature, one notices the androcentrism that permeates research; examples of androcentrism in biology range from the gendered metaphors used to describe non-human animal behavior, to the male-centric analyses of reproductive processes. For this project, sources on the subject of mammalian reproduction were compiled and studied using the lens of the female perspective. This research was later used to engage with science communication, contribute to the development of the 2020 version of Dr. Virginia Hayssen's First-Year Seminar ("Mammalian Reproduction: The Female Perspective"), and frame data analyses.

With science communication, the project investigated current barriers to unbiased science reporting on the free, online encyclopedia Wikipedia. In particular, through the creation of educational videos, the project used data trends to raise awareness of how the guidelines for article approval hinder gender equity in biography sections, as well as impede the revision of outdated research within the sections on reproductive biology.

With the First-Year Seminar, the project compiled sources relevant to the research within the textbook, "Reproduction in Mammals: The Female Perspective" (Hayssen & Orr 2017). Further, the project determined ways in which the female perspective could be explored via a remote mode of instruction.

Finally, with data analysis, the project used the Journal of Mammalogy's 2015-2020 submitting author data to investigate the potential impact of COVID-19 stay-home orders on gender equity in publishing; for this analysis, Emily Blackwell, a fellow SURF student of Dr. Virginia Hayssen, and I utilized RStudio to analyze and present gendered data submission trends.

Through various forms of engagement with the female perspective, such as through science communication, data analysis, and analysis of existing biological research, this project examined how bias in the biological sciences may be identified and combatted.

Works cited:

Hayssen, V., & Orr, T. J. (2017). Reproduction in Mammals: The Female Perspective (1st ed.). Johns Hopkins University Press. https://www.amazon.com/Reproduction-Mammals-Perspective-Virginia-Hayssen/dp/1421423154

SURF Abstract Submission & Post Program Survey 2020

Name   Zoe Gardner

Year of Graduation   2022

SURF Advisor   Barresi, Michael; Biological Sciences

SURF Field of Study   Biology

Title of Abstract/Research

Developing experiments to examine behavioral phenotypes associated with Reelin protein pathway mutations in Danio rerio

Please type your abstract below.

Reelin is an extracellular glycoprotein known to play a key role in both brian patterning and synaptogenesis. Abnormal Reelin signaling has been linked to a number of psychiatric disorders including: Autism Spectrum Disorder, Schizophrenia, Alzihmers, and Bipolar Disorder. Reelin interacts with two cellular receptors Very Low Density Lipoprotein receptor (Vldlr) and Apolipoprotein E receptor-2 (ApoER2) both of which transduce downstream signals via Disabled1 (Dab1), which is a cytoplasmic adaptor protein. Previous Barresi lab members were able to develop loss of function mutations for each of the above-mentioned pathway proteins and began the work of characterizing the role of these genes in neuronal differentiation and positioning.

My focus for the past six months has been researching zebrafish behavior and developing a methodology that will allow us to examine behavioral phenotypes that our Reelin pathway mutants might exhibit. The Barresi lab has previously collaborated with Yale University to examine the activity level of larvae with Reelin pathway mutations. I have focused on researching zebrafish behavior generally and common behavioral experiments. I examined the behavioral phenotypes found to be associated with the Reelin protein pathway in zebrafish, mice, and humans. I linked these two focuses together by identifying experiments that could be used to examine the behaviors that researchers have previously linked to Reelin deficiencies. I put together summaries of various assays along with details on how they could be conducted by individuals within the Barresi lab. I also created a very basic summary of applicable zebrafish behavior to serve as a resource for members of the lab.

I wrote out the methodology for two experiments based on a paper that had previously examined Reelin behavioral phenotypes in zebrafish, these two experiments are the novel tank diving test and 5 chambered tank assay. The novel tank diving test will allow us to examine anxiety-like behavior whereas the 5 chambered tank assay will allow us to examine social preference and response to social novelty. Based on previous studies, I hypothesize that we will see no significant difference between the wild type and mutant lines in the novel tank test, but in the 5 chambered tank assay will see Reelin -/- subjects differ from their wild type peers by preferring familiar conspecifics over new conspecifics. Throughout the summer, I presented my ideas in a few lab meetings and received and adapted to the feedback of my fellow researchers. I hope to be able to implement this methodology as soon as possible, though when that will be is unknown at this moment.