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UConn

ENRICHMENT PROGRAMS

OFFICE OF
UNDERGRADUATE RESEARCH

2020

FRONTIERS

UNDERGRADUATE RESEARCH ONLINE EXHIBITION

Welcome

to the 2020 Frontiers Online Exhibition! Like most events and campus traditions, Frontiers looks different in 2020. When it became impossible to hold Frontiers exhibitions as planned on the Storrs and Stamford campuses, we invited students to submit summaries of their research or creative projects and reflections on their learning for compilation in this exhibition program. Students also had the option to share materials associated with their projects online via Portfolium; links to those materials are included in the program alongside the individual project listings.

Should you wish to explore the materials shared in Portfolium, please visit this page:

portfolium.com/discover/tag/uconnfrontiers2020

We thank students, faculty mentors, and staff colleagues for their patience, support, and positivity as Frontiers moved online. We are pleased to have this opportunity to celebrate students' ideas, questions, explorations, discoveries, and creations in a form that matches this moment.

- UConn Office of Undergraduate Research

About Frontiers in Undergraduate Research

The Frontiers Exhibition is a multidisciplinary research forum and the largest showcase of undergraduate research, scholarship, and creative projects at the University of Connecticut. Frontiers 2020 is the twenty-third annual Frontiers event sponsored by the Office of Undergraduate Research (OUR) and the first held online. This year's exhibition includes 116 students sharing 91 research and creative projects; a student index begins on p.104.

Students' projects span the disciplines and include both independent research and work pursued in collaboration with other undergraduates. The projects presented reflect the invaluable contributions of research mentors, including graduate students, postdoctoral scholars, staff, and faculty members. We hope you enjoy learning about our students' innovative projects.

About the Office of Undergraduate Research

The Office of Undergraduate Research (OUR) is a resource for students interested in enriching their undergraduate experience through participation in research, scholarship, and creative activity. OUR provides information and advising to assist students in identifying relevant opportunities, as well as several funding programs to support students and their faculty mentors.

Many of the Frontiers presenters have received financial support for their projects; OUR awarded over \$650,000 in 2018-19 in support of students' research and creative endeavors. These awards are funded by OUR with generous support from the Office of the Provost, the Office of the Vice President for Research, the deans of the schools and colleges, and donations from alumni, parents, and other friends of UConn and undergraduate research.

Acknowledgments

The Office of Undergraduate Research wishes to thank the deans of the represented schools and colleges, the Office of the Provost, the Office of the Vice President for Research, and generous donors to OUR and the Honors Program for their support of undergraduate research through contributions to OUR funding programs. In addition, we thank the following individuals for their support:

Thomas C. Katsouleas

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John Volin

Vice Provost for Academic Affairs

Jennifer Lease Butts

Assistant Vice Provost for Enrichment Programs and Director, Honors Program

OUR extends special thanks to **Kaitlin Heenehan**, Honors Program Assistant Director for UConn Stamford, for initiating the Frontiers – Stamford event and collaborating on the development of this online exhibition.

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PEER RESEARCH AMBASSADORS

Chenghong Deng '20 (CLAS)

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Brendan Hogan '21 (CLAS)

Abigail LaFontan '20 (CLAS)

Maria Latta '20 (PHR)

Shreya Murthy '21 (CLAS, BUS)

Grace Nichols '20 (CLAS)

Kavita Rana '20 (CLAS)

Ian Sands '20 (ENG)

Mary Vlamis '20 (CLAS)

Mentorship Awards

In recognition of the pivotal role that mentors play in supporting undergraduate research and creative activity, the Office of Undergraduate Research offers annual awards for outstanding mentorship. Each year, a committee of Peer Research Ambassadors reviews students' nominations and selects two faculty members and one graduate student who exemplify the ways in which outstanding mentors challenge and support their students, enabling them to take intellectual risks and achieve milestones they might not have initially envisioned being able to reach.

Please join us in congratulating the 2020 Mentorship Excellence Award recipients.

Laura Bunyan

Assistant Professor in Residence, Sociology

Professor Bunyan was nominated by Jenifer Gaitan '21 (CLAS). Jenifer's nomination is excerpted here.

Dr. Bunyan has written countless letters of recommendation on my behalf and edited dozens of pages of my research proposals, literature reviews, applications, and presentations while providing constructive feedback. As I am a low-income student, Dr. Bunyan has helped me secure scholarships and institutional funding that have allowed me to pursue research without additional financial strain. Because of her support, I have been able to succeed as an Honors student, University Scholar, and student leader on campus. She has also advised me extensively regarding future opportunities after graduation, such as applying to graduate school. As a first-generation college student, her mentorship has led me to believe in my abilities and grow as a researcher and student.

J. Peter Gogarten

Board of Trustees Distinguished Professor, Molecular and Cell Biology

Professor Gogarten was nominated by Marlene Abouaassi '20 (CLAS). Marlene's nomination is excerpted here.

Dr. Gogarten pushes his students to seek opportunities that will advance their intellectual abilities and creativity. Since freshman year, Dr. Gogarten has gone out of his way to forward me emails about opportunities and encourage me to pursue them. If it was not for his encouragement, I would not have applied for, or been accepted to, the University Scholar program. The passion, dedication, and commitment Dr. Gogarten has for all his students to ensure they are advancing their educational experience is invaluable. I was able to grow as a student, researcher, educator, and an overall individual through the mentorship of Dr. Gogarten.


Samantha E. Lawrence

Ph.D. student, Human Development and Family Sciences

Samantha was nominated by Jessica Gagnon '20 (CLAS). Jessica's nomination is excerpted here.

As a student who was entering a lab and starting research for her thesis relatively late, I knew that I would need a supportive advisor who could help me reach my goals. When I first joined the lab, Sam sat down with me to get to know not only what I wanted to do for my project, but also who I was as a person and what I wanted to learn through my experience in the lab. She walked me through what my project would actually look like, while also identifying all the areas she could help me with throughout the process. She made it clear from the beginning that she was on my team and would do everything in her power to help me have a successful year. There have been many times where I felt unsure of what to do. Each time, Sam has been there to pull me out of my rut and ensure that I have the plan, knowledge, and support to move forward. She represents everything that a mentor should aspire to be.

Read more about the 2020 awardees at [s.uconn.edu/OURawards2020](https://uconn.edu/OURawards2020)

The background of the page is a vibrant, abstract marbled pattern. It features swirling, organic shapes in various shades of blue, from deep navy to bright cerulean. Interspersed within these blue swirls are thin, delicate lines and speckles of gold or yellow, creating a shimmering, textured effect. The overall composition is dynamic and visually rich.

STUDENT PROJECTS

Exploring Student Epistemic Practices as Indicators of Productive Disciplinary Engagement in STEM Classroom Activity

Bethlehem Abebe '22 (Structural Biology/Biophysics, CLAS; Computer Science, ENG)

Advisor: Todd Campbell, Professor, Curriculum and Instruction

Supported by: Work-Study Research Assistant Program

Project Summary

Our research aims to better understand the knowledge production practices students engage in as part of productive disciplinary engagement in science classrooms, as well as the extent to which specific features of lesson design play a role in the practices that are activated as students work to make progress in explaining things that happen in the world or solve problems of consequence. This research is important since only a limited number of studies exist to help foreground the emergent forms of epistemic practices learners in classrooms use to work at knowing. In the end, we believe this study will provide insight into the localized ways middle school students work at knowing and the important role specific lesson design features play in supporting productive disciplinary engagement, especially in relation to positioning students to activate useful knowledge production practices.

Reflection on Learning

This opportunity has given me the chance to gain exposure to the process of composing and submitting an IRB research proposal. I was able to learn the skills of research construction and development of a research project that examines alternative perspectives on student learning in STEM. Dr. Campbell has proven himself to be one of the most supportive and influential mentors I have had the pleasure of working with due to the experiences he has exposed me to and countless instruction he has provided me. I was able to gain a lot of insight into the research field and as each year goes by I find myself increasingly adept and capable in conducting and following research pathways independently.

Online Materials: <https://portfolio.com/entry/exploring-student-epistemic-practices>

The Guts of Blood Eaters: Identifying and Characterizing Niche Adapting Genes

Marlene Abouaassi '20 (Molecular and Cell Biology & Sociology, CLAS), University Scholar

Advisor: J. Peter Gogarten, Distinguished Professor, Molecular and Cell Biology

Supported by: UConn IDEA Grant

Project Summary

Genomic islands, also called pathogenicity islands, contain niche adapting genes that are horizontally transferred to aid microorganisms in adapting to their environments and selective pressures. The focus of my work is examining the gene operon found on a genomic island that encodes for enzymes that breakdown sialic acid in sanguivorous animals. The operon facilitates the survival and propagation of bacteria in the presence of erythrocytes. This project will examine how the acquisition of the operon genes found in microbes allow specific bacterial lineages to utilize sialic acid as an alternative source of carbon and nitrogen for growth.

Reflection on Learning

I have learned and acquired different methods and skills to effectively execute my research. I was able to expand on my knowledge on examining how the acquisition of horizontal transfer genes found in microbes allow survival and propagation of bacteria.

Test of Method to Raise Germ Free Zebrafish

Alyssa Addesso '20 (Molecular and Cell Biology, CLAS)

Advisor: Sarah Knutie, Assistant Professor, Ecology and Evolutionary Biology

Supported by: UConn IDEA Grant, OUR Supply Award

Project Summary

The microbiome has been tied to many different host functions, and disruption in the normal microbiota of organisms can negatively affect host health. In order to attribute specific functions to the microbiome, however, causal experiments should be performed. One way to do so is to create germ free organisms and compare them to non-germ free organisms. Creating germ free organisms has been difficult to achieve, as protocols often vary across labs. My study tries to replicate a known protocol to raise germ free zebrafish embryos to eight days post fertilization. In the first part of the experiment, I tested and modified the known protocol to sterilize the embryos. I found that I had to wait to sterilize the embryos at a later stage of development than what was originally stated in the known procedure in order to improve the survival rate. To then see whether the sterilized embryos were germ free following the updated protocol, I ran a new trial sterilizing the embryos at the later stage of development. I then sequenced the microbiota of eight day old embryos. I found that while the protocol did not seem to completely eliminate all of the microbes from the sterilized embryos, it did alter the bacterial community and diversity. As a result of my experiment, I came to the conclusion that more research is needed to confirm whether either protocol produces living, sterile embryos.

Reflection on Learning

Academically, I learned a lot about raising, breeding, and taking care of zebrafish. I had never worked with them prior to this academic year, and really grew to enjoy working with them. I also learned how careful you have to be while trying to raise germ free animals. A lot of work goes into ensuring that everything is sterile and nothing gets contaminated.

Non-academically, one of the biggest things I've learned is how much failure is involved in research. With almost every single step of the process, I ran into some sort of roadblock, and had to figure out a way around it to proceed. At times, it was very frustrating, but it gave me the opportunity to learn how to problem solve. Because of all of the problems, I also learned that performing an experiment from start to finish, analyzing data, and then writing about it, takes way longer than expected.

On another note, I also learned that writing everything down is super important. Being 100% confident with your data and what exactly you did is really important so that others can validate your work. Writing everything down is just a good way to not risk forgetting anything.

The Effects of CDK Inhibition on HR Repair and PARP Inhibitor Sensitivity in Ovarian Cancer

Nour Al Zouabi '23 (Physiology and Neurobiology, CLAS)

Advisor: Z. Ping Lin, Research Scientist, Department of Obstetrics, Gynecology, and Reproductive Sciences, Yale University School of Medicine

Project Summary

Background:

Women with mutation in BRCA1 or BRCA2 gene at higher risk of developing ovarian cancer. PARP inhibitors appear to be a safe and effective new option in the treatment and maintenance of relapsed, advanced BRCA1/2 mutant ovarian cancer. PARP inhibitors target BRCA-mutated ovarian cancer that is defective homologous recombination (HR) repair. CDK activity is required for HR repair in S and G2 phase of the cell cycle. Therefore, the objective of the study is to identify new drugs that impair HR repair and therefore sensitize BRCA wild type ovarian cancer cells to the PARP inhibitor olaparib. We tested selective CDKs inhibitors to determine their effect on the sensitivity of BRCA-wild type and BRCA-mutated ovarian cancer cell lines to olaparib.

Materials and Methods:

PEO1 and PEO4 cell lines were used in this study. PEO1 is a chemo sensitive BRCA2-mutant poorly differentiated serous ovarian adenocarcinoma derived from malignant ascites of a patient with a BRCA2 germ-line. PEO4, a reverted BRCA2- proficient line was derived from the same patient after the development of chemotherapeutic resistance. The inhibitors that used in this research are RO-3306 (RO), SNS-032 (SNS), and dinaciclib (DIN).

Methods include: Cytotoxicity assay, Excess over Bliss (EOB) analysis, and Western blot analysis.

Results:

RO did not enhance the sensitivity of PEO1 and PEO4 cells to olaparib. SNS did not enhance the sensitivity of PEO1 cells to olaparib. However, SNS appeared to enhance the sensitivity of PEO4 cells with increased concentrations of olaparib. Western blot analysis result suggests that SNS inhibited G1-S transition and CDK2 activity whereas RO did not.

Conclusion:

Inhibition of CDK2 by SNS selectively sensitized BRCA-wild type ovarian cancer cells to the PARP inhibitor olaparib. The combination of a CDK2 inhibitor and olaparib can be potentially used to treat BRCA-wild type ovarian cancer in patients.

Reflection on Learning

Approximately 15% percent of ovarian cancer patients are diagnosed early. The other 85% diagnosed with later stages as three and four. That means they have a lower chance of survival. As a woman, I feel passionate about addressing an illness that has such a devastating impact on the lives of so many women. In June of 2018, I began researching ovarian cancer, which affects 20,000 women each year. Because it is often diagnosed at a late stage, these women suffer to no avail. Through my research, I hope to alleviate this burden by facilitating the development of more effective treatment modalities for patients with resistant ovarian cancer. Before this experience, I did not understand how integral research is to the practice of medicine. In conducting my research, I have learned how to formulate a scientific question and follow it through. Research has taught me that when something is not effective, in this case, the current treatment for ovarian cancer, we have to find creative ways to reach the outcome desired. I am inspired by all of these women who are fighting against ovarian cancer for their lives and their loved ones. I want to help them fight cancer by giving them hope for a better future treatment. I hope to use the problem-solving skills I have gained in this experience to one day develop new ways to help patients suffering in devastated and low resource areas.

Does Socioeconomic Status (SES) Affect Children's Phonemic Awareness?

Maria Sol Anyosa '20 (Psychological Sciences & Human Development and Family Sciences, CLAS)

Shyam Patel '20 (Physiology and Neurobiology, CLAS)

Advisor: Nicole Landi, Associate Professor, Psychological Sciences

Project Summary

Current literature has found that children from families in lower socioeconomic status (SES) categories have disparities in vocabulary growth than their higher SES peers. Vocabulary is an important skill for reading development, but many other skills also underlie reading achievement, like phonemic awareness (PA). We explore the role of familial SES, broken down into parental education and occupation and income, examining the relationship between SES, vocabulary and phonemic awareness. We predicted that higher SES would predict better phonemic awareness outcomes. Our sample includes 1600 children (Mean Age=10).

First, we replicated relationships between SES, vocabulary, and reading comprehension. We used a multilinear regression analysis to explore potential relationships between SES and phonemic awareness tasks when controlling for age, handedness, IQ and past diagnoses. We found that parental occupation and positive parenting were better predictors of PA than they were of higher-order reading skills (e.g., reading comprehension), suggesting that time spent reading with parents or access to educational resources may be important for PA. One interesting finding for rapid sequential naming (a PA subtest), was that income level was the only significant predictor. This demonstrates the variability between SES variables as predictors of different reading (and related) skills. Finally, we used multilinear regression to consider models with all SES variables predicting vocabulary, all PA variables predicting vocabulary, and SES and PA variables predicting vocabulary. We found that one SES subtest (parent education), three PA subtests (BW, RSN, PDE), and positive parenting are particularly meaningful additions to predicting vocabulary.

Reflection on Learning

This research project has improved our understanding of efforts to close the United States achievement gap. This educational divide puts low-income students at an immediate disadvantage because wealthier students have been found to outperform them in reading and math. Increased funding for preschool programs has narrowed this gap in the last few years. Disadvantaged students are being given more opportunities to achieve more promising academic careers. Unfortunately, preschool is not universally offered and many children are still being left without the school readiness skills that other students are taught. Our findings suggest that students of low SES are in need of additional phonemic awareness instruction, highlighted by our finding that the phonemic awareness and vocabulary seem to be related to SES but have little shared variance. This means that targeted vocabulary intervention may not be enough to help low SES children catch up to their high SES peers. We know now that in order to provide children with more equal learning opportunities, we must highlight the importance of phonemic awareness skills for closing the achievement gap. This project has also given us a way to suggest actionable changes. Considerations like which SES variables seem to have the greatest relationship with phonemic awareness measures and why helps us to begin to understand what might be mediating this relationship. Similarly, finding a phonemic awareness variable that seems not to be correlated with SES allows us to use a measure that may be able to provide a sense of children's phonemic awareness without the influence of SES.

Online Materials: <https://portfolio.com/entry/does-ses-affect-childrens-phonemic-awareness-1>

Investigating Ectopic Centromere Formation in the Female *Drosophila* Germ Line

Misbah Aziz '20 (Molecular and Cell Biology, CLAS)

Advisor: Barbara Mellone, Associate Professor, Molecular and Cell Biology

Project Summary

The centromere is a specialized region of the chromosome required for proper cell division. It is composed of highly repetitive centromeric DNA and specialized nucleosomes containing the histone H3 variant, CENP-A. CENP-A deposition, by the CAL1 assembly factor, is tightly regulated in order to avoid the formation of de novo centromeres and subsequent genome instability. A recent publication from the Mellone lab has revealed that targeting CENP-A to non-centromeric regions can lead to de novo centromere formation and maintenance in mitotic tissue (Palladino et al., 2020); however the role of CENP-A chromatin in centromere identity remains elusive in meiotic tissue. The goal of my project is to determine if CENP-A chromatin is sufficient to establish a centromere at non-centromeric DNA in *Drosophila melanogaster* germline cells.

In order to study this, I utilized the lacO/LacI protein tethering system and the GAL4/UAS system. LacO repeat arrays can be integrated at multiple chromosomal locations. By fusing CAL1 to the lac Repressor protein LacI, CAL1 is tethered to the integrated lacO repeats and CENP-A can be deposited at the lacO insertion. The GAL4/UAS system is utilized to activate the lacO/LacI tethering system in the female germ line during early development. I used immunofluorescence and fluorescence in situ hybridization to analyze germline cell morphology, as well as the efficacy of the lacO/LacI system in inducing de novo centromere formation. The preliminary results of my study demonstrate various developmental defects in the female germ line and no evidence of ectopic centromere assembly. This data suggest that de novo centromeres may be forming, but the affected cells die rapidly and are not visualized in my assays.

My work is particularly important because it has broader implications for human health. Errors during cell division are an underlying cause of genetic abnormalities such as birth defects and cancer progression. My results also introduce questions about what regulatory pathways may exist in the female germ line, an area that requires further study.

Reflection on Learning

During my time working on this project, I have learned several important lessons about the research process. For example, I came to recognize the value in synthesizing and presenting my work. Recently, I presented at the 9th UConn Fly Club Symposium. There, I was able to interact with and receive advice from multiple experts in the field of genetics. This experience provided me with the opportunity to investigate my project from a different perspective. I was able to fill in gaps in my knowledge, crafting stronger explanations of my data and topics to explore for my project. The process of presenting at lab meetings and symposiums also allowed me to strengthen my written and oral communication skills. These skills will aid me in my journey towards becoming a physician, as effective communication is vital in facilitating long-lasting patient relationships.

I have also learned the importance of teamwork and collaboration in research. At the Fly Club Symposium, I was able to make connections with researchers in other labs and learn additional lab techniques for future experiments. I have also received tremendous support from my lab mates. They have guided me in conducting various protocols and analyzing my results. Moreover, they are always eager to provide helpful feedback and ideas when I am troubleshooting my experiments. Most importantly, I was able to learn that research is a rewarding experience consisting of both successes and failures, requiring patience, determination, and persistence.

Role of Phonological Processing Skills in Reading Ability in a Diverse Subject Pool

Michaela Barratt '20 (Psychological Sciences, CLAS)

Amy Ziegelmeier '20 (Biological Sciences, CLAS)

Arun Narikatte '20 (Molecular and Cell Biology, CLAS)

Advisor: Nicole Landi, Associate Professor, Psychological Sciences

Project Summary

The underlying cognitive mechanisms of reading difficulty (i.e., dyslexia) are poorly delineated. While it is known that phonological processing, the ability to discriminate and manipulate sounds (phonemes), is involved in reading, we are interested in determining the importance of distinct domains of phonological processing including phonemic awareness, phonological working memory and phonological retrieval. In this project, we used a multiple regression model to determine the association of each of these three domains with reading scores. We found that scores on phonemic awareness tasks were strongly associated with reading scores compared to scores on working memory and retrieval tasks. These results may reflect the differences in effort required in each task, suggesting that variation in reading ability is more attributed to processes involved in phonemic awareness which require direct manipulation of phonemes.

Reflection on Learning

Amy Ziegelmeier: Before this, I have never created a research poster to present. By being a part of this project, I learned a lot about how to develop a research poster from start to finish and I feel this will help me a lot in the future. I also learned more about regression analysis, which I have had very little exposure to in the past.

Michaela Barratt: Learning to work with a large database set and using behavioral assessments.

Arun Narikatte: I learned how to interpret different statistical tools in order to find relationships between variables that we think may be related. I also became familiar with various behavioral assessments used to indirectly measure aspects of reading.

The State of Diabetes Knowledge Among Incarcerated Men: A Secondary Analysis

Rebecca Bernardo '20 (Nursing, NUR)

Advisor: Louise Reagan, Assistant Professor, Nursing

Project Summary

Background: Research surrounding diabetes (DM) knowledge among incarcerated persons with diabetes is minimal, some evidence supports the existence of critical knowledge deficits among incarcerated males. Having adequate DM knowledge is a necessary component for diabetes self-management (DSM).

Purpose: The purpose of this study was to describe the state of DM knowledge among incarcerated men in a state correctional system in the northeast.

Methods: A secondary analysis was conducted merging cross-sectional data from a study examining the relationship of illness representation, DM knowledge, and self-care behavior with glycemic control in incarcerated persons with DM (n=116 males) and baseline data from a feasibility & acceptability study evaluating a literacy tailored 6-session Diabetes Survival Skills intervention for incarcerated persons preparing to transition to the community (n=92 males). Diabetes knowledge was measured by the 10-item Spoken Knowledge in Low Literacy for Diabetes scale (SKILLD). Descriptive statistics were used to describe sample characteristics and correlation coefficients to describe relationships among variables. The study was guided by the Information Motivation Behavioral Skills model.

Results: Most participants (N=208) had Type 2 DM (71%), and were using insulin (85.1%) with a mean age of 47.3 (SD 9.3) years and duration of DM 10.5 (SD 8.6) years. The majority of participants (74.3 %) were incarcerated < 5 years, and black (40.4%) with 27.9% classifying as Latino and 27.4% white, and 76.9% of the participants had < HS/GED education. The mean total SKILLD score was 6.3 (SD 2.4) with 39.4% knowing the recommended target A1C level, the normal fasting blood glucose (25.4%) and having a knowledge of the symptoms of hypoglycemia (46.6%) and hyperglycemia (52.3%), respectively with 76% knowing how to treat hypoglycemia. Higher total SKILLD scores were associated with longer duration of DM ($p<0.01$), higher education level ($p=0.01$), and being on insulin ($p=0.01$).

Conclusion/Implications: Findings from this study suggest that incarcerated persons with DM have knowledge deficits in key areas such as knowing the normal fasting blood glucose, A1C values, signs of hypoglycemia, and frequency of foot checks. Persons with shorter duration of illness and lower education levels may benefit from targeted diabetes education but future research is needed to evaluate the significance of study findings.

Reflection on Learning

By engaging in this secondary analysis for my honors project, I learned about the many steps that must be taken in performing a research study and enhanced my knowledge of performing data analysis using SPSS statistics. I have also gained a better understanding of how to assess the quality/ credibility of study findings. My appreciation for research has grown and I recognize the potential for positive change that may be elicited from study findings. For example, in our study we found that certain areas of diabetes knowledge are lacking in the incarcerated male population and thus this may indicate the need for emphasis on such areas in providing diabetes education to this population. As a future nurse, I aspire to continually educate myself regarding new research findings and provide evidence-based care. I hope to engage in more nursing research focused on addressing the needs of underserved populations as I gain experience in nursing.

Online Materials: <https://portfolio.com/entry/diabetes-knowledge-among-incarcerated-men>

Relationship Between School Wellness Policy Language and Implementation: The WellSAT and WellSAT-I

Emily Burke '20 (IMJR: Youth Development and Wellness, CLAS)

Advisors: Marlene Schwartz, Professor, Human Development and Family Sciences; Monica van Beusekom, Director, Individualized and Interdisciplinary Studies Program

Supported by: OUR Travel Award

Project Summary

As of 2006, all school districts are federally required by the Child Nutrition and WIC Reauthorization Act to establish wellness policies that describe how they will address topics related to the prevention of childhood obesity; specifically, nutrition education, the school nutrition environment, and physical activity. The Wellness School Assessment Tool (WellSAT) was developed in order for schools to assess how well their written policies align with federal regulations and best practices. The aim of this study was to use the newly developed WellSAT Interview (WellSAT-I) to compare written wellness policies of four Connecticut school districts to reported practices within the schools and to identify the various ways in which the difference between the written language of wellness policies effects how practices are implemented.

Reflection on Learning

By engaging in this project, I have obtained the necessary skills to collect and analyze information regarding school wellness policies in public school districts. These skills will directly transfer to my pursuance of a Master's in Public Health once I graduate from UConn, as well as my potential career in the field. I learned a lot about what goes into the development of wellness policies, as well as the strategies used to implement them successfully in schools, including recommended best practices.

Effects of Alloying on Dislocation Nucleation in a [001] SrNi₂P₂

Kiera Burns '21 (Mechanical Engineering, ENG)

Advisor: Seok-Woo Lee, Assistant Professor, Materials Science and Engineering

Project Summary

Spherical nanoindentation experimentation was conducted on SrNi₂P₂, a superelastic intermetallic compound and its alloyed structures, in order to understand the effects of alloying on dislocation nucleation behavior. These materials have attracted a great amount of interest due to their potential cryogenic actuation capabilities, however their mechanical robustness has yet to be investigated. The first step performed regarding the experimentation of such a superelastic intermetallic compound and its alloyed structures, included the examination of dislocation nucleation under spherical indentation. From here, the results were analyzed and interpreted in terms of the development of local residual stress.

Experimental nanoindentation on the following superelastic intermetallic compounds: SrNi₂P₂, SrNi_{1.8}Pd_{0.2}P₂, and SrNi_{1.8}Rh_{0.2}P₂ was conducted using a Berkovich tip, with an applied load of 45mN over the course of 25 indentation trials per sample. After conducting multiple nanoindentation tests on each sample, it was discovered that SrNi_{1.8}Rh_{0.2}P₂ experienced a smaller pop-in shear stress, of which corresponds to the critical shear stress of dislocation nucleation, as compared to that of the other two materials. Such a small value for the critical shear stress can be attributed to possible lattice distortion due to the difference in atomic radius. The process of alloying was conducted by replacing Ni with either Pd or Rh, and the difference in atomic radius for Rh (37 pm) was much larger than that for Pd (0 pm). Thus, the presence of large residual shear stress is expected in SrNi_{1.8}Rh_{0.2}P₂ and should influence the plastic slip that is triggered by dislocation nucleation. Future work consists of the development of the micromechanics model with the computed elastic constants in order to calculate the residual shear stress in a slip system, as well as to compare it with the experimental data (~1.88 GPa). High Resolution transmission electron microscopy could also be useful to quantify the lattice distortion.

Reflection on Learning

By engaging in this project, I have learned how to operate nanoindentation apparatus and data analysis tools, while gaining knowledge on various aspects of Materials Science and Engineering, including concepts of contact mechanics and the effects of irregularities in crystal structures. Having a background in Mechanical Engineering, with minimal prior MSE exposure, I was afforded the opportunity to learn more about the mechanical and material properties of compounds with mechanical system applications. Such an understanding allowed for the investigation of a material capable of functioning within an instrument intended for deep space exploration. Therefore, this unprecedented research could have a long term, and hopefully monumental, influence on our knowledge and implementation of potential cryogenic shape memory materials. The findings and further exploration of these compounds could lead to their use in applications within the medical and aerospace industries, as well as their employment in space exploration. My participation in this research project was not only beneficial, informative, and influential, but invaluable as well.

Online Materials: <https://portfolium.com/entry/alloying-effects-dislocation-nucleation-in-srni2p2>

Consumer Response to Green Brands vs. Traditional Brands on Digital Platforms

Madison Busick '20 (Digital Media and Design, SFA)

Advisor: John Murphy, Assistant Professor in Residence, Digital Media and Design

Project Summary

The environmental movement and social media use are both at an all-time high. But how are companies harnessing these factors in their marketing? This study looks into how eco-friendly brands fare on digital platforms compared to more traditional brands. I selected four brands that put their environmental impact before profit, as well as competitors in each of their respective industries. Using digital analytics platforms, I compared these brands in their engagement, reach, sentiment values, gender, age, region, and platform breakdowns. The results could influence companies to consider being more environmentally friendly to improve their image with consumers and help brands that are already green to enhance their online strategy.

Reflection on Learning

I learned how to manage a large, independent project and improved my skills in digital analytics. I also got to see how companies innovate and embrace corporate responsibility in their business models.

Online Materials: <https://portfolio.com/entry/honors-thesis-consumer-response-to-green-brands>

Hope in the Neoliberal Policy: An Assessment of Mexico's Energy Sector

Luis Cruz Dosamantes '20 (Political Science & Economics, CLAS)

Advisors: Oksan Bayulgen, Associate Professor, Political Science; Matthew Singer, Associate Professor, Political Science

Project Summary

This thesis contrasts the era of economically nationalist practice in the Mexican oil sector since the nationalization of the sector in 1938 with the Energy Reform of 2013. Mexico's oil sector underwent a change from an economic growth policy characterized by the protection of the domestic market through the use of tariffs and the isolation of the national market from international competition, to one defined by the privatization of some state-owned companies and the attempted modernization of the country's oil sector in an effort to ensure its success in the international arena. Contrary to past literature, I find that the Energy Reform was not truly neoliberal, and, thus, the full set of anticipated benefits were not achieved after its implementation.

Reflection on Learning

This project challenged me to learn more about the economic history of Mexico and use it to evaluate the most recent reform in the Mexican energy sector. I learned that there is a lot of literature in regard to this subject, however, most of it assumes that the reform was truly neoliberal in nature. In my critique and the study of neoliberal indicators, I find that this is not the case. Although Mexico has liberated other sectors of its economy and privatized large companies, Mexicans refuse to hand over their oil to private companies, despite reforms like the one evaluated here.

My advisors Professor Bayulgen and Professor Singer were very helpful in giving structure and vision to this project. I am indebted to them for their revisions to my writing and their continued support and encouragement throughout this project.

Meta-Network Analysis of Complex Construction Systems: Improving Project Efficiency Using Novel Computer-Based Analytic Methodology

Ethan Cummiskey '21 (Civil Engineering, ENG)

Advisor: Jin Zhu, Assistant Professor, Civil and Environmental Engineering

Project Summary

Construction projects are very complex systems that can be optimized with correct planning and analysis. In this study, a meta-network analysis method was introduced for analyzing the interactions of different construction agents on the tasks they are assigned based on the information and resources they possess on the job. The method was tested in studying the University of Connecticut Athletic Development District Project. Using ORA and MATLAB, a meta-network for the foundation part of the project was modeled and analyzed. The efficiency of the project was assessed based on network measurements such as agent assignment completion and resource/information waste. The ultimate goal of this analysis is to explore optimization strategies to keep an organized project environment that reduces the overall waste of resources while preserving the budget and schedule of the project.

Reflection on Learning

This project taught me a lot about the research process as well as deepened my understanding of various tools towards solving problems. I was able to set up my own model to test the idea of construction analysis based on the real world example of a project ongoing at UConn Storrs. I had no real guidelines or parameters except for the ones I gave myself which was challenging in its own right as I was in total control of the experimental setup. I learned to adapt and question my own ideas so that I could create the best version of this model possible. This took many iterations and drafts but it left me with a comprehensive model that I could perform analyses on. Furthermore, I had to overcome many hurdles such as experimenting and refining the use of the ORA Meta-Network analysis software and teaching myself MATLAB to write code that brings an extra layer of realism to the model. This coding in MATLAB was especially rewarding as I was able to develop factors that make this analysis not only realistic to actual construction projects but useful so that all this work was legitimized. It was an extremely rewarding experience and I was able to learn that this constant effort really breeds progress and shows that any development is possible with enough work towards a goal.

Online Materials: <https://portfolio.com/entry/meta-network-analysis-of-construction-systems>

The Ketone Body Beta-hydroxybutyrate Attenuates Pathological Markers in a *Drosophila* model of Alzheimer's Disease

Celya Dahmani '21 (Physiology and Neurobiology & French, CLAS)

Advisor: Geoffrey Tanner, Assistant Professor in Residence, Physiology and Neurobiology

Supported by: SURF Award – Antonio and Alison Caxide Award for Undergraduate Research

Project Summary

Alzheimer's disease (AD) is a neurodegenerative disease characterized by decreased cognition – including difficulties with learning and memory – caused by progressive neuronal and synaptic degeneration (Chen and Zhong, 2013; Hoglund et al. 2015; Wang et al., 2015). The AD pathology is often characterized by an accumulation of hyperphosphorylated tau (a protein that is integral for microtubule stabilization) resulting in the formation of neurotoxic tau aggregates (also known as neurofibrillary tangles) (Hoglund et al., 2015). These aggregates hinder glycolytic metabolism in neurons and degradation of the myelin sheaths eventually ensues, producing ketone bodies (KB), which may then be metabolized for energy (Chen and Zhong, 2013; Yao et al., 2011). Based on recent studies that have been conducted in the Tanner Lab, the ketogenic diet (KD) has been shown to exhibit neuroprotective effects in a chronic traumatic encephalopathy (CTE) model of *Drosophila melanogaster* (Lee et al., 2019). The KD bypasses glycolysis in favor of ketogenesis, thus elevating cellular ATP/ADP ratios (Appleton and DeVivo, 1974). We are currently using a *Drosophila* model of AD that allows for temporal control of glial tau protein expression to induce tauopathy. We directly apply the ketone body metabolite beta-hydroxybutyrate (β -HB) to a standard high-carbohydrate *Drosophila* diet to determine whether KB supplementation may ameliorate AD-associated learning deficits. Learning deficits were measured by preference index testing through a learning rig. We found that β -HB markedly improves tauopathy-induced learning deficits and reduced levels of phosphorylated tau in male *Drosophila* brains.

Reflection on Learning

After spending countless hours in the lab this summer, I gained not only a sense of independence and responsibility, but also the realization that my contributions will have at least somewhat of an impact in the scientific realm. This realization motivated me to ensure the accuracy of my data and to ask more questions pertaining to potential issues that could affect our results. I have also become much more familiar with techniques used in quantifying data such as the process of scoring and the uses of mRNA extraction, western blot analyses, and proteomics. Additionally, I gained a greater understanding of the application of concepts in genetics and biology to scientific research especially through performing crosses for our various lines of *Drosophila*. Moreover, I find that I have become more familiar with the way researchers communicate their findings as our lab works towards releasing a paper this fall. My projects throughout the summer have allowed me both to collect and validate additional preliminary data while also perfecting experimental techniques for further studies in the fall.

Online Materials: <https://portfolio.com/entry/celya-dahmani-tanner-lab-frontiers-2020>

A Performance Database for Studying the Structure of Human Semantic Knowledge

Jonathan Daniel '20 (Molecular and Cell Biology, CLAS)

Purna Dalal '22 (Biological Sciences & Sociology, CLAS)

Samantha Grubb '21 (Speech, Language, and Hearing Sciences, CLAS; Computer Science, ENG)

Advisor: James Magnuson, Professor, Psychological Sciences

Supported by: PCLB Psychological Sciences Undergraduate Research Grant

Project Summary

This project titled "A Performance Database for Studying the Structure of Human Semantic Knowledge" was conducted in the Magnuson Lab by the undergraduates in the lab with the help of the graduate students and our PI. The goal of this experiment was to build a database of semantic judgments for spoken word recognition. This database will assist our lab in future research along with future researchers who are exploring the effect of semantic variables in spoken word recognition.

To form this database, we created a list of 1016 nouns, made up by 508 monosyllabic and 508 bisyllabic nouns. This list was spoken by 4 talkers, forming 4 total lists, one by each talker: one male and one female, and one synthetic male and one synthetic female. Each participant received one of the four lists. Upon hearing the stimuli, they made a semantic decision of whether it was possible to touch the noun heard in the stimuli. What made this a semantic decision was making the participant consider the meaning of the word before choosing between the two options of "Can touch" and "Cannot touch." The data showed us an inverted U-shaped curve as the relationship between reaction time and concreteness, showing a gradual increase in reaction time as words become more concrete, and then a large speeding effect as concreteness increased. The concreteness was rated on a scale of 1-5, with 1 being abstract and 5 being concrete.

This implies to us that very abstract words such as "justice," or very concrete words such as "truck" were much easier and faster to recognize in comparison to more ambiguous words such as "vehicle." Our study and the resulting database will help us to develop a better understanding of how semantic relatedness influences online spoken word recognition, with the potential to aid in the study of language development and language disorders in the long run.

Reflection on Learning

Jonathan Daniel: Through making and conducting this project, I have learned so much about semantic decision making and the processes of spoken word recognition which I would have never encountered in any other area of my life. As I plan to be a physician, I will continue conducting research regarding speech recognition and disorders along with my other ventures, as being a part of this lab has brought me to be very interested in the topics. The realization that there is so much that I don't know about what seems to be the simple task of hearing a word or sentence, and giving a response, was and still is mind blowing. Having the opportunity to work in this lab and on this project has helped me build on my own personal skills such as teamwork and critical thinking in conjunction with research based skills such as making an experiment, conducting it, and analyzing the data collected. These skills are going to assist me throughout my career and life.

Online Materials: <https://portfolium.com/entry/a-performance-database-for-studying-the-structure>

Approach Biases in People Demonstrating Problematic Gaming Habits

Julia DeVincenzi '20 (Biological Sciences & Spanish, CLAS)

Advisor: Robert Astur, Professor, Psychological Sciences

Supported by: OUR Travel Award

Project Summary

Behavioral addictions including pornography, internet use, gambling, and video games demonstrate similar features to substance addictions including altered brain circuitry leading to a skewed sense of risk, response to treatment, and certain comorbidities (Jacobus, Taylor & Gray, 2018; Stacy & Wiers, 2010; Hull, Brunelle, Prescott & Sargent, 2014). With the recent development of technology and social media, there has been a lot of new research into the cognitive effects of high video game usage, and it has become especially pertinent considering that individuals exhibiting these addiction-level habits have an increased chance of exhibiting altered social relationships, worsening academic performance, lack of attention to basic personal needs, and an impaired perception of self (Király, Nagygyörgy, Griffiths, & Demetrovics, 2014; Männikkö, Billieux, & Kääriäinen, 2015, Jacobs Df, 2986; Kim & Hodgins 2018). Within the realm of addiction diagnosis lies a theory that individuals demonstrating addiction-level habits demonstrate an automatic impulse to approach rather than avoid addiction-related stimuli (Field et. al., 2008). The extent of this approach bias can be measured using a task known as the approach-avoidance task; participants are asked to pull or push a joystick based on a property of the picture (in this case image orientation) regardless of its content (Cousijn, Goudriaan & Wiers, 2011). In this study, 131 students at the University of Connecticut with varying levels of video game usage, as determined by the Problematic Online Gaming questionnaire (POGQ), were recruited to participate. Individuals were instructed to push or pull a joystick in response to a property of an image unrelated to its content, in this case the orientation of the image (e.g., horizontal vs. vertical) (Wiers et. al., 2011). Images themselves consisted of a combination of 'neutral' and 'sensitive' stimuli divided into two separate tasks, and consequent reaction times were recorded. Results indicate an overall approach bias toward sensitive stimuli when compared to neutral stimuli, but an approach bias was not found in individuals classified as problematic gamers. However, frequency and severity of video game use was positively correlated with an increase in gaming, pornography use, and social anhedonia, as well as a reduced quality of life. Additionally, we observed a significant approach bias towards video game stimuli among participants who reported pornography usage.

Reflection on Learning

More than anything, the process of organizing, compiling, analyzing and presenting my research has taught me the value of patience. I didn't realize how much cooperation and participation was required by so many different groups just to get the ball rolling. I am very grateful to have had the experience to work with the faculty and undergraduates at the University of Connecticut, and have a newfound appreciation for the inner workings of the scientific research community.

EEG Mu Rhythm Desynchronization and Language in 18- and 24-month-old Infants

Marcella DiBona '20 (Psychological Sciences, CLAS)

Emily Hotz '20 (Psychological Sciences, CLAS)

Advisor: Kimberly Cuevas, Associate Professor, Psychological Sciences

Supported by: OUR Travel Award

Project Summary

Our research focuses on the neural mirroring system (NMS)--overlapping brain activity during action observation and action execution. One way to measure NMS activity is via electroencephalography (EEG). The EEG mu rhythm, recorded from central scalp sites, desynchronizes (i.e. decreases in power from baseline) during the perception and performance of goal-directed actions (Marshall et al., 2010). Previous work with 18- and 24-month-olds revealed 6-9 Hz mu rhythm desynchronization (MRD) during observed actions and auditory verb processing (Antognini & Daum, 2019). Thus, the NMS is activated early in life and may be related to broader social cognitive measures, such as language development. In the present study, we examined potential associations between the EEG mu rhythm and language abilities in 18- (n = 17) and 24-month-old (n = 18) infants. Because action perception and language are both forms of social cognition, we hypothesized that 18- and 24-month-olds with greater language abilities will have greater MRD during action observation.

We collected EEG as infants observed an experimenter performing a goal-directed action (i.e., reaching for a toy). They were given the opportunity to execute the same action, and also observed a 3-s baseline stimulus displaying non-biological movement. We used the MacArthur-Bates Communicative Development Inventories (MCDI) questionnaire (Fenson et al., 2007), a parent-report measure of infant productive language abilities. Infants exhibited significant 6-9 Hz MRD at central sites during action execution. The association between total vocabulary and action observation MRD was significant at 18 [$r(15) = -.52$, $p = .018$], but not 24 months. Thus, 18-month-olds with greater language abilities exhibited smaller MRD values (i.e., greater MRD). Future analyses will examine these factors in a broader sample and with additional language measures using individualized mu frequency bands, providing further information about the role of the NMS in language development.

Reflection on Learning

Engaging in this project has allowed us to gain a new set of skills that have enriched our educational experience. We have been responsible for collecting, analyzing, coding, and entering data, all of which have enhanced our skills and knowledge of EEG and developmental research in general. This experience has also provided us the opportunity to interpret our findings as well as strengthen our professional writing skills. Specific to our research, we have learned how children's language abilities may be related to brain activity. This opportunity has provided us with hands-on experience in conducting and presenting research, a tool that will benefit us in our future academic training and professional careers.

Online Materials: <https://portfolio.com/entry/eeg-mu-rhythm-and-language-in-18-24-month-olds>

Temperature Regulates the Properties of KCNQ2/KCNQ3 Channels

Klarita Doci '20 (Physiology and Neurobiology, CLAS), University Scholar

Advisor: Anastasios Tzingounis, Professor, Physiology and Neurobiology

Project Summary

KCNQ potassium channels, expressed in the brain, play an important role in controlling neuronal excitability. KCNQ2 and KCNQ3 channels are thought to mediate a slow activating, non-inactivating potassium conductance, the M-current. M-currents activate close to the resting-membrane potentials of neurons counteracting excessive neuronal firing. The M-current is mediated by KCNQ2 and KCNQ3 channels formed as an heteromeric complex. The heteromeric channels have higher probability of opening, due to higher P_o of KCNQ3 channels over KCNQ2 channels. Currently, most experiments so far on KCNQ2 and KCNQ3 channels have been done at room temperature. This assumes that the properties of KCNQ2/3 channels are the same between room temperature and physiological temperature. Here we compared the properties of wild-type KCNQ2/KCNQ3 channels as well as KCNQ2/KCNQ3 pathogenic variants found in patients with epilepsy and autism. We found contrary to the common assumption that the biophysical properties of KCNQ2/KCNQ3 channels depend on temperature.

Reflection on Learning

I began working in Dr. Tzingounis's lab during the summer following my sophomore year. Working during the summer on a full-time basis gave me the opportunity to understand what entails in inquiry-based science. The brain has always fascinated me, especially when one considers the power this organ holds. During my freshman year of high school, I spent a summer in Germany and stayed with a host family, who had a child diagnosed with autism. My everyday experience with him, observing his behavior and the way he perceives the world, opened my eyes to the reality that autism, although prevalent in our society, still lacks a mechanistic understanding. Thus, I was particularly interested in pursuing a project that integrates my medical interests with basic science research. I have been lucky to have a supportive lab group that was always available and helpful in any problems that I faced.

Online Materials: <https://portfolio.com/entry/temperature-regulates-the-properties-of-kcnq2kcnq3>

Public Matters? Comparing Decision-Making by Appointed and Elected Prosecutors in Cases of Deadly Use-of-Force by Police in the Hartford Judicial District and Suffolk County

Andrew Dubsky '20 (Political Science & Psychological Sciences, CLAS)

Advisors: Kimberly Bergendahl, Assistant Professor in Residence, Political Science; Matthew Singer, Associate Professor, Political Science

Supported by: CLAS Alan R. Bennett Honors Fund

Project Summary

This thesis dissects the issue of prosecutor discretion for both appointed and elected prosecutors after a “catalyst” event shifts public opinion. Previous studies have shown that prosecutors who are elected are more likely to use discretion favoring the opinion of the public than their appointed counterparts (Bandyopadhyay 2014, Nelson 2014, and Valenti 2011). Because elected prosecutors are more likely to follow public opinion, they should also be more likely to respond to the demands of the public than their appointed counterparts. In effect, elected prosecutors are expected to be more likely to exercise discretion in their charging and prosecuting decisions than their appointed counterparts. To test this, I identify the 2014 shooting of Michael Brown as a “catalyst” event that highlights the social movement against police misconduct in the eyes of the public. I then collect data from cases involving policing shootings 14 years before the catalyst event (since 2000) and then from the catalyst event to the end of 2019. These cases are taken from districts under the jurisdiction of appointed States Attorney Gail P. Hardy of Hartford County, Connecticut and elected District Attorney Rachael Rollins of Suffolk County, Massachusetts. I compare the total number of cases, the circumstances behind each incident, the outcomes of each alleged case of misconduct, and any similarities or differences between cases before and after the catalyst event. While there was an increase in cases involving police shootings in both jurisdictions since the catalyst event, there were no significant differences in terms of the outcomes these cases after the catalyst in both jurisdictions. Prosecutions of officers involved in shootings remained extremely rare in both counties both before and after the catalyst.

Reflection on Learning

My biggest takeaways from completing my thesis were my respect for research as a whole and the revelation that I possess the ability to accomplish such a large project. I say I gained respect for research because going through the process of a single research project was difficult, complicated, and at times frustrating. Taking my experience and imposing that onto the numerous works published by my peers and supervisors, and I cannot imagine how they have the fortitude to work on so many projects. Simply put, independent research was hard, and I have learned so much from individuals who are able to dedicate their lives to the craft.

While I say it was difficult, researching and writing my thesis was an amazing experience. If you had told me as an incoming freshman that I would conduct my own research and write a thesis on it, I would have laughed. But this project tested my own perception of my abilities and tested the boundaries of what I thought I was capable of. I learned that those boundaries were comfortable, but they were holding me back. They kept me from learning how to take sincere constructive criticism, learning how to use that criticism, and even recognizing myself when my work can improve. So I am grateful for the opportunity to share this senior thesis, as it grew to the work you see now as I grew as an academic.

Online Materials: <https://portfolio.com/entry/senior-thesis-public-matters>

Near IR Tethered Bichromophoric Fluorophore-Quencher Voltage Sensitive Dye

Daniel Fairchild '21 (Structural Biology/Biophysics & Molecular and Cell Biology, CLAS)

Advisors: Ping Yan, Assistant Professor, Center for Cell Analysis and Modeling; James Cole, Professor, Molecular and Cell Biology

Supported by: Health Research Program

Project Summary

Traditionally, measuring electrical activity within a cell is done using electrodes. Electrodes are able to give accurate and fast measurement of a changing electrical potential. Electrodes do however have a severe drawback in that they can only be used on a single cell or very small groups of cells. Voltage sensitive fluorescent dyes (VSDs) serve a similar function as an electrode, however, they have the added benefit of being able to provide a high-resolution image over a much greater area. Presently, voltage sensitive dyes are either limited in their sensitivity and brightness which results in a poor signal-noise ratio or they do not have the appropriate response time to accurately track a changing electrical potential. Recently, a new class of voltage sensitive dyes has been synthesized called tethered bichromophoric fluorophore-quencher dyes (TBFQ dyes). These TBFQ dyes are highly sensitive and demonstrate great promise in moving the field of VSDs forward. A TBFQ with near infrared (NIR) activity could possibly allow for deep tissue imaging making it a more accessible technique for a broader range of purposes. The quencher-fluorophore combination uses Förster resonance energy transfer (FRET), in which the emission spectrum of the fluorophore matches the excitation spectrum of the quencher. When this occurs, the fluorescence from the fluorophore is quenched while the quencher and fluorophore are in close proximity and the fluorophore is allowed to fluoresce when they are distant. The distance between the quencher and fluorophore is controlled based on an applied voltage as well as the length and composition of the tether joining the two.

Reflection on Learning

This project has taught me a significant amount about organic synthesis, nuclear magnetic resonance imaging as well as fluorescence imaging techniques. It has provided me with great insight into the expansive research process that occurred to make nearly all of the biological and chemical achievements we see in our everyday lives.

Online Materials: <https://portfolium.com/entry/synthesis-of-a-tethered-cy-7-oxonol-vsd>

Extraction of Cannabinoids from Hemp and CBD Products for Potency Analysis Utilizing UPLC-UV

Spencer Fontaine '20 (Chemistry, CLAS)

Jorleny Torres '21 (Molecular and Cell Biology, CLAS; Medical Laboratory Sciences, CAHNR)

Ethan Beri '22 (Psychological Sciences, CLAS)

Ying Liu '20 (Economics, CLAS)

Advisors: Anthony Provatas, Academic Assistant II, Center for Environmental Sciences and Engineering; James Stuart, Senior Research Scientist, Center for Environmental Sciences and Engineering, and Professor Emeritus, Chemistry; Christopher Perkins, Academic Assistant II, Center for Environmental Sciences and Engineering

Project Summary

In recent years, interest in Cannabis as it pertains to medicine has been rapidly increasing. Cannabidiol (CBD) is one of over 100 organic compounds produced by the Cannabis plant, and recent discoveries have exemplified the multi-beneficial use of such compounds. As of 2018, the industrial growth of hemp became legal; this bill defines hemp as cannabis with a concentration of tetrahydrocannabinol (THC) less than or equal to 0.3%, where THC is the psychoactive component of cannabis. With the hemp industry growing rapidly, it is important to have a reliable method to quantify the potency of THC and CBD in hemp and CBD products. This study outlines a process utilizing a liquid/liquid extraction technique and subsequent analysis by ultra-performance liquid chromatography-Ultraviolet detection (UPLC-UV) for hemp and CBD products. Due to the absence of an official Standardized Operating Procedure (SOP), an in-house SOP was developed for the extractions. Samples were garnered from various hemp distributors across the New England region for analysis.

Reflection on Learning

Spencer Fontaine: This project gave me exposure to the growing hemp industry and provided me with information on the different chemical components of cannabis. This project also gave me an opportunity to observe how a SOP is developed.

Online Materials: <https://portfolio.com/entry/extraction-of-cannabinoids-from-hemp-and-cbd>

Barriers to Research of Cannabis Use During Pregnancy

Yvonne Kimberley Francois '20 (IMJR: Race, Gender, and Ethnicity in Healthcare, CLAS)

Crystal Johanna Yumbla '22 (Psychological Sciences, CLAS)

Juan Torvisco '20 (Allied Health Sciences, CAHNR)

Advisor: Ruth Lucas, Assistant Professor, Nursing

Supported by: Work-Study Research Assistant Program (C. Yumbla)

Project Summary

The purpose of this study is to describe the feasibility of recruiting pregnant women who use cannabis. The journey of scientific discovery is built upon successes and failures. This study describes the strategies and barriers encountered in recruiting pregnant women who use cannabis into a research study. The population that we are studying has been historically known to be vulnerable. Since we are exploring the potential harms of cannabis on fetuses in a state in which recreational cannabis is legalized, there were some major setbacks. As recreational cannabis is becoming legalized in more states, research on this needs to be done, however, the stigma around women who are cannabis users has been one of major barriers.

The abundance of misinformation about the effects of cannabis use and the stigmatization of pregnant women who are cannabis users have made the research of this specific population challenging. After 18 months of recruiting, we have been unsuccessful to recruit any women for our cannabis use in pregnancy study. We have written a research paper that compares the recruitment techniques of our study and the literature already published to discuss the barriers associated with recruiting a vulnerable population. Throughout the study, we learned the stigma around women who are cannabis users is so polarizing that it has made the recruiting process challenging. Furthermore, this stigma contributed to what we could only hypothesize to be fear in women being willing to participate in our study.

In conclusion, we do not condone the use of cannabis due to the potential effects on the fetus and women. However, if we do not study the phenomenon, we will not know if women who use cannabis manage their pregnancy symptoms of nausea and discomfort or if they have a genetic risk of pain sensitivity and risk inhibition. By understanding these mechanisms, we can target our professional and clinical care to provide an alternative treatment for physiological discomfort or provide behavioral interventions. Recruitment of pregnant women who use cannabis is deeply rooted in stigma. In order to properly reach this population, identifying and implementing strategies without stigma must be the focus of researchers.

Reflection on Learning

Yve Francois: As someone who is passionate about the field of maternal and child health, this project aligned perfectly with my interests. Throughout this process, I have learned that recruitment of vulnerable populations involves a large amount of time and patience. The research that we are doing is necessary to the field of science. We need to eliminate the stigma associated with researching vulnerable populations. I learned valuable skills in recruitment, how to pivot research interests when data collection has come to a standstill, and how to effectively communicate ideas to a wide range of professionals. Science is an evolving field that is heavily reliant upon collaboration and communication. We as researchers need to have face-to-face interactions with key community members to ensure the success of studies. Research should not just be bodies of published work; it should work together with surrounding communities to effect positive change.

Crystal Yumbla: As the research team and myself began this research, we found that the most problems happened when trying to acquire participants. I learned a lot about the process of recruitment and the difficulties that can come along, especially with our population of interest. It was definitely a valuable lesson to learn and implement here on out, especially in future research. My particular interest stems in the OB/GYN field, and having such difficulty with recruiting this population in research has allowed me to learn a lot about this population as a whole. Teamwork was also a large portion of this project; and it allowed for independence with parts that contribute to the whole which is an important aspect of research.

Juan Torvisco: As an aspiring nurse student, I learned a lot about the significance of research and how significant social views on different topics can influence the recruitment process. The difficulties that we experienced in recruiting participants for our study revealed significant problems in society's understanding of the importance of research. This has allowed me to see how difficult research can be when presented with challenges created by negative views on topics that need more research. The accessibility of data in women who use cannabis during pregnancy is not out there because stigma has prevented us from accessing this population. However, another thing that I learned is how to create and introduce prevention methods to access our target population and successfully obtain the numbers of participants that we need to produce meaningful conclusions.

Online Materials: <https://portfolio.com/entry/cannabis-research-study>

Investigation of Ethics of 23andMe®: Direct-to-Consumer Genetic Testing in the Age of the Genetic Revolution

Madeline French '20 (Molecular and Cell Biology & Philosophy, CLAS)

Advisor: Colleen Spurling, Assistant Professor in Residence, Molecular and Cell Biology

Project Summary

The genetic revolution has allowed for unprecedented strides in how we understand ourselves and disease, allowing for personalized medical treatments and accurate diagnostic testing. Amidst this scientific boom, issues arose concerning ownership of genetic information, genetic discrimination, and impact on health insurance. The perceived deterministic nature of genetics had both intrigued and scared the public eye and a market for inexpensive genetic testing services blossomed. 23andMe is a popular direct-to-consumer genetic testing that provides health and ancestry reports with the mission to promote access to understanding and benefitting from their genome. However, the privatization of genetic testing and compiling of data may present issues regarding privacy and impersonal delivery of predictive health traits and ancestry results could negatively affect the consumer. The goal of this project is to explore controversial aspects of the 23andMe service and produce helpful explanations of methodology and results for interested consumers.

Reflection on Learning

The conception of this idea originated in an effort to bring my knowledge and experience from my second major, Philosophy, into exploring concepts of Molecular and Cell Biology, specifically genetics. While working on this project, I learned about the influence of powerful scientific writing on the public and the importance of thorough, effective communication to alleviate stress, anxiety, and confusion concerning intimidating topics like genetics. I found that controversies like that of my project focus require more common conversation so that moral discussion of genetic and biotechnology advances are not suffocated by exponential growth in scientific progress in order to promote proactive rather than reactive policy and protocol.

Africans and Their Descendants in Imperial Iberoamerica

Jenifer Gaitan '21 (History, CLAS), University Scholar

Advisor: Ricardo Salazar-Rey, Assistant Professor, History

Supported by: SHARE Award

Project Summary

This project focused on slavery in the Spanish Empire. My goal was to translate and make available the legal testimonies of enslaved Africans and their descendents in Latin America in order to understand history from their perspective. I focused specifically on Spanish South America by studying a handwritten legal case that was transcribed by my colleague, paleographer Adriana Maria Martinez Aguirre. This gives the reader a direct glimpse into the lives and relationships of enslaved people, their enslavers, and the society they lived in. The case took place in Cartagena de Indias, modern day Colombia. This city has a significant role in the history of the Transatlantic Slave Trade since it served for nearly two centuries as the only authorized port for the importation of enslaved Africans in Spanish South America. The case I studied was from 1572 and although it is incomplete, the folios document a trial in which an enslaved man, Lorenzo Negro, was being accused of seriously injuring a man. In the case, it is revealed that there was evidence that Lorenzo was promised freedom in exchange for carrying out this planned attack. The attack took place on one of the busiest times of the year, Holy Week. Witnesses say they saw Lorenzo was disguised as a disciplinante and he infiltrated the procession in order to be in close proximity to Pedro Perez, the man who was stabbed in his face and was searching for the assailant.

Reflection on Learning

This was my first time working with primary documents in Spanish. Even as a native speaker, reading transcribed old Spanish was a challenge. This project also required copious amounts of background information. Reading the case was always coupled with hours of looking up definitions of words, research on laws and the legal system, and social context of the environment in which the case took place. This research also exposed me to the complexities of working with documents that are several centuries old, such as missing folios making the case incomplete. This was a rewarding yet challenging project as a History student and Spanish speaker, but it helped reinforce my analytical and research skills.

Voces: First Generation Latinx College Students Discuss Their Support Networks

Jenifer Gaitan '21 (History, CLAS), University Scholar

Advisor: Laura Bunyan, Assistant Professor in Residence, Sociology

Supported by: OUR Supply Award, OUR Travel Award, Work-Study Research Assistant Program

Project Summary

As of July 2017, the Latinx population made up 18.1% of the country's total population, making it the largest ethnic minority group in the USA (U.S. Census Bureau 2018). A 2011-2012 study found that one-third of students enrolled in colleges and universities were first-generation students (Cataldi, Bennett, Chen 2018). These are students with parents who have not graduated from a U.S. college or university. As a growing population, the number of Latinx (a gender-neutral term for people of Latin American descent) students in higher education is also increasing, many of whom are immigrants and first-generation college students.

In order to graduate with a bachelor's degree, first-generation Latinx students must balance a complex and demanding workload of paid work and family, academic, and social responsibilities. Institutions can lack trained staff, faculty and resources that specifically seek to help first-generation students. Many students piece together a support system through memberships in organizations, faculty and staff at the college or university they attend, and their peers. In order to contribute to the scholarship surrounding first-generation Latinx college students, my project focuses on exploring the systems of support first-generation Latinx college students utilize throughout their undergraduate degree and the impact that these systems of support have on their college experiences and outcomes. In conducting preliminary research, I have found that both the percentage of Latinx people in the U.S.A and the number of Latinx college students has significantly increased over the last few years. I also discovered that many first-generation Latinx students rely on support systems through family members and mentors to navigate higher education and tend to do better academically and socially when they have this type of support.

Reflection on Learning

This project represents the first phase of my work, focused on preliminary research in order to have a thorough understanding of first-generation and Latinx students. I gained data analysis skills through my study of quantitative and qualitative data. I also learned to locate relevant information for a relatively understudied but rapidly growing group of college students. These research findings helped shape the next phase of my research, which will include interviews with students. This project was presented at the Eastern Sociological Conference in Philadelphia, which also helped reinforce my oral presentation skills to give concise information in a short time frame.

Online Materials: <https://portfolium.com/entry/voces-first-generation-latinx-students>

The Bacterial Serine Dipeptide Lipid, Lipid 654, Attenuates Atherosclerosis Development in LDL-Receptor Knockout Mice Fed a Western-Type Diet

Chelsea Garcia '20 (Nutritional Sciences, CAHNR), McNair Scholar, University Scholar

Advisor: Christopher Blesso, Associate Professor, Nutritional Sciences

Supported by: McNair Scholars Program

Project Summary

Inflammation is a critical component of several diseases such as atherosclerosis, Alzheimer's disease and multiple sclerosis (MS). Both inflammation and risk for these diseases are commonly exacerbated with the intake of unhealthy diets, inducing a state of chronic low-grade inflammation. Atherosclerosis and MS have been associated with altered levels of Lipid 654 (L654) produced by the Bacteroidetes phylum, a main player of the gut microbiota. L654 is a serine dipeptide lipid which has been shown to induce inflammation via Toll-like receptor 2 (TLR2). High fat diet (HFD) consumption has been associated with decreased Bacteroidetes, which may result in lower levels of circulating L654. Furthermore, serum L654 levels were found to be lower in patients with MS and Alzheimer's, while the ratio of metabolite, Lipid 430, to L654 was increased in aortic plaques. There is some evidence that chronic exposure to TLR2 agonists may induce a state of peripheral immune tolerance, with reductions in inflammation.

We investigated the effects of chronic L654 administration on markers of inflammation and energy balance in the liver and brain tissues, as well as atherosclerosis development in transgenic mice fed a high-sucrose, Western-type HFD. Mice were fed either a standard chow diet or HFD for 14 weeks. During the last 7 weeks of the HFD, mice were intraperitoneal-injected 3 times per week with either 1 µg of L654 or a control solution (vehicle). L654 had a hypocholesterolemic effect with L654 treated mice having significantly lower cholesterol concentrations in the liver compared to the vehicle. L654 also reduced hepatic inflammation, as L654 lowered serum ALT and hepatic pro-inflammatory gene expression compared to the vehicle. In the brain, HFD reduced some inflammatory markers compared to chow, whereas L654 increased their expression relative to HFD, while being similar to that of chow. Finally, L654 attenuated atherosclerosis, as L654 injected mice had significantly lower aortic root lesion size compared to vehicle. In summary, chronic L654 administration protected against several metabolic defects in peripheral tissues induced by Western-type diet, including hyperlipidemia, liver inflammation, and atherosclerosis development. However, these changes were not observed in the brain.

Reflection on Learning

Through the completion of this project, I learned a lot about neuroinflammation and energy balance in the context of a HFD. In addition, I learned about the recently discovered bacterial lipid L654 and its role in protecting against hepatic inflammation and atherosclerosis. However, L654 did not play a protective role against neuroinflammation. This project allowed me to work on my oral and communication skills in addition to my critical thinking skills. These are skills that I will continue to build on throughout graduate school.

Legislating the Birds and the Bees: Evaluating the Effectiveness of State Sexuality Education Mandates

Miranda Garcia '20 (Political Science, CLAS)

Advisor: Virginia Hettinger, Associate Professor, Political Science

Project Summary

This study examines the educational factors contributing to several health and behavioral outcomes, including teenage pregnancy, STD/STI rates of high school aged students, and gender-based violence among adolescents in the United States. The three main forms of sexuality education in the United States include abstinence-only, abstinence-plus, and comprehensive. In this study, each state is given a score for "comprehensiveness" of its sexuality education mandate calculated using the Guttmacher Institute's definition; this score is then compared with the health outcomes to analyze the influence of the mandatory sexuality education programs on students' health and behavior. Further, the study controls for basic demographic information of the state, including overarching political ideology, religiosity, and average education level. I hypothesized that the higher the comprehensiveness score, the lower the rate of negative outcomes. However, this did not always prove to be the case.

Findings suggest that a state's comprehensiveness score and the presence of abstinence in the education affect students' sexual health and behavior with less frequency than the social and economic environment in which the students live. Therefore, more research is needed in order to determine the best model of sexuality education for students, as the current system is not necessarily achieving all of its desired outcomes. There are open possibilities for further research, including a more in depth study of municipalities and school districts to learn more about what these state mandates actually look like in practice. Another next step might be to design a curriculum based on the Guttmacher definition used in this study and implement it into schools with varying populations. What is most important is that more research be done to ensure that we are giving the young people in this country the best education they can get.

Reflection on Learning

I learned so much from doing this project. First, I learned that I think we can be doing more justice for our kids in this country in terms of sex education. To have mandates in place that appear to not be accomplishing what they are meant to accomplish is a red flag to me. I think that sexuality is an important, and universal, human experience and that it is important that young people are taught that it is not something to fear. It is also important for people to be able to talk about sex, answer kids' questions about it, and to try our best to stop sexual harm based on false information and biased teachings.

I also learned that I have a passion for education policy. It may sound like a cliché, but kids really are our future. The next generation of leaders needs to be informed, confident, and generally happy. I plan to continue this type of research and work however I best can in the future, from the UConn Masters of Public Administration Program and my career thereafter because I know these are important issues and they need to be addressed.

Online Materials: <https://portfolio.com/entry/legislating-the-birds-and-the-bees>

A Quantitative Pipeline For The Identification of Combinations of Targets for Claudin-Low Triple Negative Breast Cancer Reversion

Madeleine Gastonguay '20 (Applied Mathematics, CLAS), Holster Scholar

Advisor: Paola Vera-Licona, Assistant Professor, Center For Quantitative Medicine

Supported by: SURF Award – Trimble Family Award

Project Summary

Claudin-Low Triple Negative Breast Cancer (CL TNBC) has high relapse and low survival rates. Due to the tumors' decreased response to cytotoxic drugs and hormone therapy, alternative therapeutic strategies should be explored. One such strategy is tumor reversion, the biological process by which tumor cells lose a significant fraction of their malignant phenotype. Tumor reversion has been observed for over a century and has been achieved in vitro, in vivo, and ex vivo. In particular, tumor reversion has been achieved in vitro with the CL cell line MDA-MB-231, and ex vivo in mice xenografted with MDA-MB-231 cells. This project takes a dynamical systems approach to identify in silico combinations of therapeutic targets for CL TNBC reversion. An intracellular signaling network was reconstructed with multi-omics profile data for MDA-MB-231. Then a structure-based attractor-based control method for nonlinear dynamic systems was applied to the network to identify driver nodes of the system. Topological signal flow analysis was applied to the network for virtual screenings of driver node perturbations to predict their effect on the system. Combinations of nodes whose concerted perturbation resulted in the system shifting from the tumorigenic basin of attraction to the normal-like basin of attraction were deemed putative concerted reversion targets. Through this methodology, several potential combinations of targets that may shift the cell from a tumorigenic to a normal-like phenotype have been identified to be further validated in future work.

Reflection on Learning

The amount I have learned working on this project for the past two years is immense. Aside from gaining a deeper understanding of dynamical systems and cancer reversion, my skills in python, R, LaTeX, literature comprehension, and troubleshooting have greatly improved. I learned how to effectively communicate ideas, work as a team, and accept that "perfect" is the enemy of "good enough." I'm incredibly grateful to the Trimble family for funding the Summer Undergraduate Research Fund I received for this work, and to my mentor, Dr. Paola Vera-Licona, and graduate student, Lauren Marazzi, for their endless support and tutelage.

Networking with Raspberry Pi's using R5RS Scheme

Agron Gemajli '23 (Computer Science, ENG)

Agasti Mhatre '23 (Computer Science, ENG; Financial Management, BUS)

Advisor: Phillip Bradford, Associate Professor in Residence, Computer Science and Engineering

Project Summary

"Could we get multiple Raspberry PI's to speak with one another through Scheme Revised(5)?" In other words, "Could we get multiple mini-computers to remotely talk to one another using a programming language written in the 1990s?" Since the programming language was outdated, the language did not have any functionality for connecting to the network or even being able to use all the modern pieces of technology today.

For our project we first took to set up multiple raspberry pi's (RPIs). Since our effort was to try and limit the budget as close to \$0 as possible, we opted to run virtual machines that contained the RPI system on our host machine running Windows. We learned that RPIs used a different system type which caused a few issues. Once we got through the system problem, we tried to connect all these virtual machines together on a private network. Getting the old programming language to access the network was the most challenging part we faced. Through a connection called SISC, we were able to get the machines to speak with one another by using a specific network protocol called TCP. Once we got the communications working, we created a simple client/server banking program that allows all the machines to talk to one another using Scheme.

This project will outline the future usage of the Scheme Revised(5) code. Using this knowledge, more modern approaches such as blockchain technology can be achieved using this project. With the documentation provided, this could inform future creative endeavors by providing the framework to create modern software.

Reflection on Learning

After our experience with the project, we have come to see programming in a more different light. Scheme Revised(5) is a great language to learn the basic concepts of programming and as we applied our current knowledge on the language, we were able to gain a new insight on this could be used in the modern day applications.

Before the project, there were many things that we did not know about, such as virtualizing a raspberry pi on a 64-bit architecture machine. We now know that there are modified kernels out in the web and a virtualization platform known as QEMU that allows us to attach those modified kernels to work with the 64-bit architecture. We also ran into a problem with getting the raspberry pi's to communicate with one another. We did not know if there was a way to string the machines together like using a network switch that assigns IP's directly. On the virtual machine hosting the raspberry pi's, there was an ability to create virtual network interfaces. We now know that through using these virtual interfaces, we could now string multiple machines together and connect to them through the same network virtually. We also did not know that SISC is a ported version of Scheme using the JVM environment but now we understand that we could utilize SISC to propagate potential new software.

There are also some issues we have detected but do not know much about. We now know that there are potential problems with using multi-threading on SISC due to the JVM environment it is running on. We also know that there are many different methods available through SISC interpreter that we have not been able to use due to limitations placed on memory and processor usage.

Online Materials: <https://portfolio.com/entry/networking-with-raspberry-pis-using-r5rs-scheme>

Developing a Robust Extraction Method for the Determination of Per- and Polyfluoroalkyl Compounds (PFASs) in Tissue Followed by Ultra High Performance Liquid Chromatography-Tandem Mass Spectrometry Analysis

Grace Greene '20 (Chemistry, CLAS)

Crystal Vu '21 (Environmental Science, CAHNR)

Christian Pyle '20 (Allied Health Sciences, CAHNR)

Isabelle Razon '20 (Biological Sciences, CLAS)

Advisors: Anthony Provatas, Academic Assistant II, Center for Environmental Sciences and Engineering; James Stuart, Senior Research Scientist, Center for Environmental Sciences and Engineering, and Professor Emeritus, Chemistry; Christopher Perkins, Academic Assistant II, Center for Environmental Sciences and Engineering

Project Summary

Per- and poly- fluoroalkyl compounds, or PFASs, are a class of environmentally persistent compounds especially resistant to degradation. PFASs have the ability to spread out in a thin film across flammable liquids, so they are often used in specialized firefighting foams called AFFFs (aqueous film forming foams.) These firefighting foams are used on air bases, airports, and firefighting training facilities. They become introduced into the environment when extinguishing crash fires and during training exercises. Because of the adverse health effects associated with high concentrations of PFASs in tissue, including certain cancers, reproductive issues, and liver and kidney toxicity, analysis of extracted PFAS concentrations is critical to mitigating human exposure to these chemicals.

This project analyzed liver and muscle tissue from deer living in the forest surrounding a former New England military air base that used AFFFs. There is at this time, no standardized procedure for PFAS extraction from tissue, so the procedure used was derived from EPA method 537.1 for extracting PFAS from drinking water. Following extraction, the supernatant was analyzed using Ultra High Performance Liquid Chromatography Tandem Mass Spectrometry (UHPLC-MS/MS) for fourteen PFAS compounds. The reporting limits ranged from 0.45 to 26.8 ng/g. Four of the thirty one deer tissue samples had a detectable PFAS concentration.

Reflection on Learning

Grace Greene: Through this project, I have a better understanding of how pervasive PFASs have become not only in areas where there have been spills, but in consumer products, like detergents and food packaging. I worked in a clean room for the first time and was confronted with how many considerations needed to be made to prevent contamination. Despite all efforts to prevent contamination, there were still contaminated samples, which emphasized again how common PFASs were and showed me that further alterations always have to be considered when developing a new methodology.

Crystal Vu: Engaging in this project allowed me to have a better understanding of PFAS. Working towards the detection of PFAS made me realize how ubiquitous it is as we had to substitute several equipment that did not contain PFAS and work in a clean room. This project gave me the opportunity to learn more about its origins, how its structure contributes to its persistent nature, and how developing such methods are significant to understanding the presence of PFAS within the environment.

Isabelle Razon: Being a part of this project has allowed me to learn more about PFAS and how dangerous it is to both the environment and living things. I think it's important that we continue to do research on PFAS because of how prevalent it is in our daily lives and because of the fact that there isn't much research concerning its presence in humans and animals.

Online Materials: <https://portfolio.com/entry/extraction-method-for-the-determination-of-pfass>

The Phonological Structure of Human Lexical Knowledge

Samantha Grubb '21 (Speech, Language, and Hearing Sciences, CLAS; Computer Science, ENG)

Jonathan Daniel '20 (Molecular and Cell Biology, CLAS)

Purna Dalal '22 (Biological Sciences & Sociology, CLAS)

Advisor: James Magnuson, Professor, Psychological Sciences

Supported by: Institute for the Brain and Cognitive Sciences (IBACS) Undergraduate Research Grant

Project Summary

Theories of spoken word recognition agree that as a word is heard, multiple words are activated in memory and compete for recognition, and that words are activated based on similarity to the unfolding input. They disagree on similarity metrics. The Neighborhood Activation Model uses global (overall) similarity; words are neighbors if they differ by one phoneme (sound). Other theories use word onset similarity; words are cohorts if they share initial phonemes. We are building a performance database to help us understand how phonological similarity affects spoken word recognition. Additionally, we compare onset- vs. offset-anchoring of reaction time, a choice that researchers have used flexibly in some past studies. Participants completed a lexical decision task on 1,016 items from one talker (participants had to determine whether each item was a word). Items were produced by four talkers. We recruited 55 participants and calculated reaction times for correct responses to words. We found that higher frequency words have faster reaction times. The effect of phonological neighbors reverses from onset-anchoring to offset-anchoring. Larger cohort size is associated with slower response times from word onset, but not from word offset. This suggests that different reaction time anchors capture different aspects of the complex process of human spoken word recognition. We also found weak correlations between talkers, suggesting that databases need multiple talkers.

Reflection on Learning

Samantha Grubb: This project has taught me about the process of developing a research project, collecting data, and interpreting and presenting results. I have seen the details of creating a study firsthand and it has taught me how to critically think about research questions and targeted ways to test theories and find answers. This has taught me about project management and staying organized and productive to have things finished in due time. Having worked on this project from the beginning to the end, it has shown me how much I enjoy developing a project and seeing its results. I have learned that I enjoy engaging in research and hope to pursue it further. I am very grateful to have had this opportunity to engage in research and to further my education on a topic I am interested in. Research has allowed me to develop new skills and have a hands-on learning experience I would not have had otherwise.

Online Materials: <https://portfolio.com/pp/14CF15F8-0B70-4653-94FB-DA5A0B752DFB>

Actin Assembly and Microtubule Reorganization By Formin-1 In Vitro and in Cells

Kelsey Hebert '20 (Molecular and Cell Biology, CLAS), STEM Scholar

Advisor: Kenneth Campellone, Associate Professor, Molecular and Cell Biology

Supported by: SURF Award

Project Summary

Actin filaments and microtubules are essential cytoskeletal polymers that are assembled and organized by the Formin family of proteins. Formin-1 (FMN1) was the first member of this family to be discovered, yet remains among the least understood. Moreover, an E377G polymorphism in mouse FMN1/isoform-IV (FMN1-IV) has been linked to decreased severity of Alport syndrome, a glomerular disease that leads to renal failure. To determine the normal roles of FMN1 in cytoskeletal regulation and identify the effects of the E377G polymorphism, I investigated the in vitro and cellular functions of wild type and mutant versions of FMN1-IV. To assess the biochemical properties of FMN1-IV, I purified recombinant untagged forms of wild type and mutant FMN1-IV for use in pyrene-actin polymerization assays and in microtubule co-sedimentation assays. Although the microtubule-binding experiments had to be postponed, the actin assembly studies showed that FMN1-IV possesses potent actin nucleation activity in vitro and is not auto-inhibited like other Formins. These properties were unaffected by the E377G mutation. To examine the cellular phenotypes of FMN1-IV, I cloned GFP-FMN1-IV plasmids, transiently transfected them into kidney fibroblasts, and quantified cellular F-actin levels, microtubule organization, and FMN1-IV localization. Consistent with the biochemical assays, the wild type and mutant versions of FMN1-IV both polymerized F-actin in the cytosol with potencies greater than those of other nucleation factors. Both FMN1-IV constructs also exhibited a cytoplasmic localization with enrichment at membrane ruffles and surrounding the nucleus, and both promoted microtubule bundling. Unexpectedly, the FMN1-IV proteins additionally formed phase-separated structures, with the mutant appearing to be more prone to this type of localization. Collectively, my results further our understanding of the biochemical and cellular properties of FMN1-IV as well as their potential relationships to Alport syndrome.

Reflection on Learning

Throughout my entire experience in the lab and getting to spend last summer there full-time, I learned many laboratory techniques and methods including protein purification, cell culture, biochemical assays, and immunofluorescence microscopy. My knowledge of cell biology has greatly improved, but more importantly, I have acquired lifelong skills that I will apply to my future career in research and dentistry.

Online Materials: <https://portfolio.com/entry/fmn1-actin-assembly-microtubule-reorganization>

Perceptions of Guilt of Individuals with a Visible Communication Disorder versus an Invisible Communication Disorder

Zoe Hochberg '20 (Speech, Language, and Hearing Sciences, CLAS)

Advisor: Bernard Grela, Associate Professor, Speech, Language, and Hearing Sciences

Project Summary

This study explored how communication disorders may impact listeners' perception of guilt. More specifically, it looked at how visible communication disorders (e.g., stuttering) and invisible communication disorders (e.g., high functioning autism) are judged by the general public. 51 adults (18-71 years) participated in the study which asked them to view video recordings of narrative samples produced by an individual who stuttered (PWS), an individual with high-functioning autism (PHFA), and an individual with no communication disorder (PNCD). Participants were not informed of the individuals' communication abilities (PWS, PHFA, or PNCD), but were told that one of the individuals had committed a crime prior to hearing the narratives. After viewing the narratives, participants filled out a questionnaire where they were asked to identify which individual committed the crime, as well as questions regarding trust, friendship and story accuracy. Results revealed that the PWS was selected least frequently as guilty, selected equal to the PHFA in desire to have as a friend, and selected the least frequently for being trusted the least. There were no differences between speakers on measures of story accuracy. The results of the study demonstrated elevated levels of leniency towards the PWS. This suggests that those with visible communication disorders are generally perceived as deserving of sympathy due to their impairment, while those with invisible communication disorders are perceived as no different from those without a communication disorder. This is important knowledge for how those with communication disorders are treated in the criminal justice system and extends to how those with communication disorders are treated in daily life.

Reflection on Learning

This was my Honors Thesis, a culmination of a year and a half of work. This was the most extensive project I have ever worked on, and the first time I have been part of a research project from the conception of the idea, to running participants, to analyzing the data, to producing the final thesis paper. Not only was it immensely valuable in solidifying my interest in the field of speech, language, and hearing sciences, but it taught me a lot about the process of completing a research project. I went into this project with a completely different idea of what the results would be. I believed that it would result in the individual who stuttered being perceived the most negatively by listeners. However, the complete opposite occurred which not only undermined my hypothesis but previous research as well. As more and more participants were run, my advisor and I were surprised by the data but quickly adapted to the new direction the research was going in. What began as a project expecting to find that those who stutter are disadvantaged in the criminal justice system transformed into a project examining how visible communication disorders, like stuttering, compare to invisible communication disorders, like high-functioning autism. I learned the importance of staying open-minded throughout the entire research process, because, as I experienced, it can easily transform into something even more valuable than initially expected.

What is the Green New Deal and How Can the UConn Community Support Its Implementation to Solve Climate Change?

Jerome Jacobs '23 (Biomedical Engineering, ENG), Rowe Scholar
Advisor: Shuowei Zhang, Visiting Assistant Professor, Geography

Project Summary

According to NASA, 97 percent of climate scientists agree that climate-warming trends over the past century are extremely likely due to human activities. Many scientific studies also confirm that our continuation on fossil fuel production and emissions, the primary driver of climate change, would only exacerbate unprecedented extreme weather phenomena across the nation, costing billions to manage in their aftermath. More importantly, the larger impact of climate change is on most vulnerable people, including lower-income people of color, and their marginalized communities in the U.S. Yet, as of February 2019, nearly 80 percent of America's energy comes from fossil fuels.

In 2017, President Trump withdrew the U.S. from the Paris Agreement, the global community's pledge to cutting carbon emissions, and made numerous changes in U.S. policies that undo the Obama administration's work on the transit to a clean energy economy. As a counterattack to such regressive shift, New York's Representative Ocasio-Cortez and Massachusetts' Senator Markey introduced the Green New Deal (GND) as the newest congressional resolution to solve climate change issues on February 7, 2019. By treating clean energy as a human right, the GND aims to ultimately eradicate all carbon emissions by 2050, based on its 10-year national mobilization plan, while also trying to fix societal problems such as economic inequality and racial discrimination in existing "frontline and vulnerable communities."

To examine the GND's feasibility and future prospect, I analyzed over 80 printed and online materials, including research papers, newspaper articles, policy documents, and websites, to identify the GND's major contributions to the U.S. and global society as an environmentally sound, economically viable, and socially responsible registration. I then describe concrete ways that the UConn community, whoever would join, can support this critical opportunity of transferring our carbon-intensive economy to carbon-neutral one via on-campus and online outreach. At UConn, for example, we can create a systemic student-led campaign to inform, discuss, and make our young voters' voices heard in implementing the GND in order to stop the greatest threat to civilization as we know it – climate change. I also explored specific strategies to increase the UConn Community's support on the GND through different social media platforms.

For climate change, everyone matters. For everyone, climate change matters.

Reflection on Learning

I designed this research as my Honors Conversion Project in the GEOG-2320: Climate Change course, taught by Professor Shuowei Zhang, in the 2019 fall semester.

As a freshman, I was thrilled to conduct a semester-long research project on my favorite topic, climate change. Every week throughout the fall semester, I spent extra hours and days in collecting and analyzing over 80 different resources, ranging from scientific peer-reviewed papers to everyday newspaper articles and websites. Thanks to this rigorous research process, I have improved my skills in the following three areas of college learning.

Firstly, I learned so much about both scientific and political approaches to solving climate change issues. I particularly loved to examine key findings from large global-scale studies such as the Special Report on Global Warming of 1.5°C by the Intergovernmental Panel on Climate Change (2018), which was based on the assessment of over 6,000 published articles. At first, I was overwhelmed to tackle this 630-page research report but soon figured out my own systemic and thorough recording system, documenting my word/concept search history and connecting multiple sections on similar issues using concept mapping exercises. This experience has certainly expanded my creative thinking, document-analysis, and problem-solving skills.

Secondly, I acquired a clear understanding of concrete procedures to campaign for various political agendas within my local community and the U.S. Government system. Although the whole scope of the GND is gigantic and abstract, balancing its global ambition and local feasibility is crucial. Considering that there are always trade-offs and sacrifices in collectively achieving this level of plan, I learned how all parties should explore multiple scenarios to identify common goals and share steps to maximize our collective benefits, especially for those in frontline and vulnerable communities. This understanding has made me become a more conscientious and compassionate student and citizen.

Lastly, I truly enjoyed my 1-to-1 learning with Professor Zhang who was extremely open, friendly, knowledgeable and professional. Whenever I felt stuck with too much information, for example, Professor Zhang guided my critical reasoning process for choosing next steps by myself, instead of instructing me to do particular tasks. He also often reminded me that my frustration on learning the GND was completely understandable because of its newness to both the public and the academic field.

This was really one of my best learning experiences at UConn.

Reversal of Amotivational Effects of Lipopolysaccharide-Induced Inflammation by 2-Deoxyglucose

Sydney Katz '20 (IMJR: Neuroscience, CLAS)

Zoha Sarwat '20 (Physiology and Neurobiology, CLAS)

Advisor: John Salamone, Distinguished Professor, Psychological Sciences

Project Summary

Research has demonstrated that inflammation is linked to motivational deficits commonly seen in Major Depressive Disorder. Lipopolysaccharide (LPS) administration induces an inflammatory response and impairs motivated behavior in rodent animal models. Evidence suggests that inflammation can interrupt the mesolimbic dopamine system to shift metabolic needs to other areas that warrant more effort expenditure to the perceived threat (e.g., fighting infection), therefore shifting motivation (Treadway et al. 2019). Animal models have been developed to specifically look at alterations in motivated behavior by giving the animal the option to either work (i.e., lever press) for a highly palatable food reward vs. approaching and consuming a freely available, albeit less palatable, food. This model was used to see if administration of 2-deoxy-D-glucose (2DG), a substance that inhibits glycolysis, could reverse the motivational deficits induced by LPS. A food preference/intake task was also conducted to see if LPS had an impact on a rodent's choice/intake of the highly palatable vs less palatable food when both are freely available. It was hypothesized that 2-DG would reverse the motivational deficits caused by LPS and there would be no effect on food preference/intake of the highly palatable food. Results showed that 2-DG significantly reversed LPS effects at the lowest dose. The food intake/preference tests showed that LPS significantly decreased food intake of both foods but did not alter preference for the highly palatable food compared to vehicle. These results imply that the main effect of LPS may be on appetite or primary food motivation, not on activation aspects of motivation as previously hypothesized.

Reflection on Learning

Sydney Katz: This project has been an eye-opening experience in the field of research. My project investigated the motivational effects of LPS, which made me think more about the broader implications this study means for the field of psychiatry. Before this project, I knew depression was complicated, but I had no idea about how pro-inflammatory cytokines could induce or exacerbate depressive symptoms. I had no idea the tired/fatigued feeling we all get before a cold was because of pro-inflammatory cytokines. I especially didn't connect the idea that the same run-down feeling before an illness is very similar to fatigue and low motivation seen in depressed patients. My thesis and other studies looking at the motivational effects of cytokines show that the immune system and depression are connected in some way. Throughout this experience, I was able to improve my critical thinking skills by trying to understand the results of how LPS affects the brain function and motivation. In order to be a researcher, someone needs to think outside the box to find a relationship between two seemingly unrelated things. Working on this thesis has affected the way I think about the brain and its interactions with the body. In the future, I would love to be able to explore the connection further between pro-inflammatory cytokines and amotivation in a research setting.

The Presence of Gender Misconceptions in Women Testing Positive for BRCA1/2 Genetic Mutations

Trane Kessler '21 (Human Development and Family Sciences & Psychological Sciences, CLAS)

Julia Levin '21 (Physiology and Neurobiology, CLAS)

Jason Chan '20 (Human Development and Family Sciences, CLAS)

Annika Anderson '20 (Human Development and Family Sciences, CLAS)

Valentina Atehortua '20 (Human Development and Family Sciences, CLAS)

Advisor: Keith Bellizzi, Associate Professor, Human Development and Family Sciences

Project Summary

The current study is a qualitative analysis of women who have tested positive for either (or both) BRCA1/2 genetic mutations within the past five years, and have specifically commented on gender misconceptions regarding inheritance and genetic mutations in males. The study aims to identify an association between the perceived gender misconceptions and the educational level of those who reported the misconceptions aforementioned, as limited research on this relationship exists.

Participants were recruited from four national online support groups for women with these genetic mutations. The interviews pinpoint how participants viewed their experience of genetic counseling and how counseling could be improved in the future. Four individuals transcribed the interviews independently verbatim. Thematic analyses were completed by two independent coders for each interview to create major and subthemes across participants. One of 34 women conveyed gender misconceptions unprovoked by the investigator during interviews. Information on the education levels of participants were initially collected within quantitative demographic surveys.

A total of 34 participants completed interviews, answering questions related to family history, genetic counseling experience, and emotional impact of test results. Upon interpretation, a main theme regarding the presence of gender misconceptions within BRCA1/2 genetic stereotypes was introduced following unprovoked responses among 9 participants (26.4%), with subthemes relating to: Males can not pass on BRCA (n=3, 8.82%), BRCA does not affect males (n=4, 11.76%), Men can not get breast cancer (n=7, 20.5%). Out of the nine participants that identified having gender misconceptions within their interview, 88.8% had a college degree or better. After analyzing each subtheme, it appears as though educational achievement is not significantly associated with the perceived gender misconceptions related to BRCA1/2 inheritance.

Approximately 25% of the qualitative sample noted gender misconceptions within their interviews. The results suggest that the high school and collegiate tiers of education need to be augmented on a curricular level to spread awareness about gender misconceptions in health and accurately inform students. This information encourages future research to gain a more in-depth understanding of gender misconceptions among college graduates as well as where these gender misconceptions are the most geographically prominent.

Reflection on Learning

Trane Kessler: Through working on this project, I learned a lot about the process of research. I gained a lot of first-hand experience that I did not previously have-- as I was able to witness and help see this project evolve and progress to completion. Although I was not there from its inception, at the beginning of the Fall 2018 semester I helped to transcribe interviews for the project. Following that, I was able to learn about the statistics involved in organizing the data, as well as play a role in its analysis and interpretation. Ultimately, through this project I also got the opportunity to play a role in the writing of an abstract and the creation of my first research poster. Overall, my experience working on this project taught me a lot about the idiosyncrasies and the research and amassed me some valuable experience in the field of academia.

Julia Levin: Jumping into this project midway made getting my footing a bit difficult, but after discussing with the other team members and garnering an understanding of the material being presented I think I was able to pull my weight as best as I could. I may not have been present for the transcription or analysis of the interviews, but I helped create the poster and find an engaging way to present the research. I was able to use my previous experience creating

scientific posters as a knowledge base, and learned a lot about different ways to present social science data throughout this process. Before joining this lab and participating in this project, I had not had the chance to consider how to present demographic characteristics of a population or trends found in transcribed interviews. The pictorial representations used in our poster have reinforced the value of images in research, and will allow me to create better presentations of my research in the future, no matter the topic.

Jason Chan: From this project, I learned that for a big research project, it is more than regular group projects I have done. I learned how you are truly part of something larger than yourself and that every member has a role to play. I also got to experience the whole research process and learn what it's truly like. For example, I learned the politics of the research project and how every single action requires approval and needs oversight before the changes can be finalized. In addition, we had to be extremely detail-oriented and we needed to be especially privy to time management as well. Working together with a team, we essentially created a system where we were responsible for each other's successes and failures while also holding others accountable and supporting our fellow student contributors to help achieve the goals of the project. I am thankful I was a part of this project as I got the opportunity to help contribute to the abstract and literature reviews. In addition, this whole project has also taught me how to view the project as a whole, not just from my point of view, but from the views of others. It is essential to know how people will think of this in order to determine how our group as a whole can put together information and details while staying true to our point. This will definitely help me in my future career at Nursing school where they have offered me to contribute to nursing research; and I intend to make the most of this newfound opportunity by applying everything I have learned about working for this project.

Annika Anderson: From this project, I learned how important it is to be patient throughout the research process, and that partaking in research requires adaptation and flexibility. Our initial role was to transcribe qualitative data, which gave me experience with detail-oriented information and time management. Across interviews, I identified themes that were neat to see come up, especially when they were unprovoked; as a team, we ended up basing this Frontiers project on this phenomenon. I also enjoyed looking at Kate's coggle of information, and using SPSS to cross-analyze the data. I have learned that research is complex, and that having a strong team is important for checks and balances of each other's responsibilities. Overall, this process has taught me that research and dissemination is so important because it guides how we live our lives. As someone outside of research, it has taught me to pay attention to other people's findings to pay closer attention to how I navigate my own life and choices.

Valentina Atehortua: This project was definitely a learning experience. This was the first time I went through this process and the challenges we experienced caused us to learn to be flexible and adapt. The first idea we had did not work for us so we had to change it. Having people guide us throughout this process was very helpful. It was nice being involved from transcribing the interviews to creating our own poster from the data.

Online Materials: <https://portfolium.com/entry/gender-misconceptions-in-brca12-patients>

The Impact of Location on Healthcare Access for Individuals with Disabilities

Addison Kimber '20 (Biological Sciences & Political Science, CLAS)

Advisors: Laura Mauldin, Assistant Professor, Human Development and Family Sciences; Matthew Singer, Associate Professor, Political Science

Supported by: CLAS Alan R. Bennett Honors Fund

Project Summary

This paper analyzes healthcare access for individuals with disabilities living in rural areas. In current political discussion, we typically think of insurance coverage as the metric to analyze healthcare access. However, as demonstrated by studies of healthcare in the United Kingdom, people with disabilities continue to face barriers to health care even with universal healthcare systems. In particular, individuals in rural areas have less healthcare access than urban residents. This is due to factors including socioeconomic status, insurance coverage, access to competent care, and transportation. This study aims to understand if disability status exacerbates the issue of access in rural areas. This paper reviews how location impacts care access through quantitative analysis of datasets regarding preventative care for individuals with disabilities. This work has found that preventative care including routine check-ups and mammograms are accessed more frequently in increasingly metropolitan areas. Some factors including dental care and mammograms also had disparities in care for disabled and nondisabled populations. These factors are viewed through the lens of the social model of disability, addressing whether rural areas are constructed in a way that supports healthcare access for people with disabilities.

Reflection on Learning

Through this project, I have learned that there is no one definitive way to conduct research. My project went through many evolutions from presentation to methodology, which allowed me to explore multiple ways to conduct research. Through this work I was exposed to many different types of research and was fortunate to speak with many professors who greatly expanded my view on my field of study.

The Anti-Inflammatory Effects of Antifolates on Acute Myeloid Leukemia Cells

Jacqueline Klepinger '20 (Molecular and Cell Biology, CLAS)

Advisor: Charles Giardina, Professor, Molecular and Cell Biology

Project Summary

Cancer cells are able to proliferate at rapid rates due to the aberrant activity of proteins involved in regulating the cell cycle. This characteristic of cancer allows mutated cells to spread and metastasize, causing lesions to form throughout the body. Two treatment conditions, one classical antifolate methotrexate (MTX) and non-classical, novel antifolate UCP1162, were tested on a panel of acute myeloid leukemia (AML) cell lines to see if UCP1162 has higher anti-proliferative activity. Methotrexate is excluded from acute myeloid leukemia (AML) treatment based on early clinical trials that suggest AML cells are intrinsically resistant. High dose MTX is used as first-line chemotherapy in common childhood malignancies such as acute lymphoid leukemia (ALL). We are interested in studying UCP1162 because much like MTX, it targets dihydrofolate reductase (DHFR). UCP1162 does not appear to be limited by the reduced folate carrier (RFC) protein or folate polyglutamate synthase (FPGS) mutations since it is not expected to use either of these mechanisms. From this, UCP1162 is expected to accumulate better intracellularly and therefore, should provide more potent and longer-lasting anti-proliferative effects. Furthermore, I would like to continue this idea by studying how the anti-proliferative activity relates to the inhibition of nucleotide synthesis and DNA methylation. The comparison between these two treatments can be assessed by assays that provide information on the cytotoxic effect that results. UCP1162 works with a lower EC50 than MTX, which may cause less cytotoxicity and side effects, allowing this treatment to be more tolerable. If UCP1162 is proven to have higher anti-proliferative effects than MTX, then it could play a key role in the arresting of cancer cells and improving patient care in the future.

Reflection on Learning

By working in Dr. Giardina's lab, I have learned how to properly perform routine cell culture procedures, such as plating and passing cells. I have familiarized myself with cancer metabolism, specifically involving the folate one-carbon metabolism. I have learned what it takes to be a dedicated research assistant and have been able to vastly improve my knowledge of bench-top protocols and manners.

Developmental Changes to the Neural Stem Cell Niche in Fetal-Onset Hydrocephalus

Saurabh Kumar '20 (Molecular and Cell Biology & Statistics, CLAS), STEM Scholar, University Scholar

Advisor: Joanne Conover, Professor, Physiology and Neurobiology

Supported by: OUR Supply Award, OUR Travel Award, IBACS Undergraduate Research Grant, SURF Award, Council on Undergraduate Research Biology Student Travel Award

Project Summary

Fetal-onset hydrocephalus is a common birth defect characterized by abnormally expanded brain ventricles. Diagnosis for this complex pathology often involves relatively simple metrics and heavy reliance on clinician experience. Those affected often suffer chronic headaches and cognitive deficits. Shunting, a common treatment for hydrocephalus, remains a highly invasive procedure often performed during the critical period of infancy and has a high failure rate of 40% within one year. Although shunting can reduce ventricle size, shunted patients often still suffer from associated cognitive deficits.

We analyzed the relationship between fetal-onset hydrocephalus and alterations to normal developmental patterns within the ventricular-subventricular zone (V-SVZ) stem cell niche – located subjacent to the lateral ventricles (LV). We utilized archival, periventricular human tissue and MRI scans from periods covering fetal through early adolescent development to: 1) develop a model of normal (non-hydrocephalic) development of the human brain's LV and the subjacent V-SVZ, and 2) analyze alterations to normal development in hydrocephalus. We have analyzed LV morphology changes including volume, surface area, and curvature metrics, in relation to changes in cell type distributions within the V-SVZ.

We have shown that during normal neural development: 1) ependymal cell formation (ependymogenesis) proceeds in a posterior to anterior fashion, 2) human LV ependymogenesis results in “pinwheel” cytoarchitecture similar to that in other mammals, 3) LV volume and surface area growth plateau growth at approximately 1.5-years, and 4) no pinwheel-core stem cells are detected by the same 1.5-year timepoint. Collectively, our findings suggest that fetal V-SVZ development in humans mirrors that in rodents but with a decline in postnatal proliferative and neurogenic potential. We also propose a relationship between observable LV volume/surface area changes from MRI scans and V-SVZ cell type changes at the cellular level.

Our hydrocephalus studies show: 1) reduced ventricle-surface stem cell counts per unit area, 2) variable degrees of astrogliosis, and 3) extensive convolutions of the ventricular lining associated with shunting. In fetal stages, hyperproliferative V-SVZ phenotypes have been observed. Collectively, we illuminate the interactions between LV morphology and V-SVZ histology to emphasize the consideration of neurodevelopmental processes during hydrocephalus treatment.

Reflection on Learning

This presentation represents the culmination of my years of research in the Conover Laboratory (UConn-PNB). Over the course of this project, I have learned how to ask important scientific questions, design thorough experiments on how to test them, and appropriately analyze results within the scope of the project. Most importantly, I have learned how to investigate questions through observational studies which may not have contained all the elements of a controlled experiment due to limitations with archival human tissue and imaging.

Online Materials: <https://portfolio.com/entry/uconn-frontiers-spring-2020>

District Regulated Nutrition Programs: Identifying the Gap Between Language in District Wellness Policies and Implementation Practices in Public Schools

Abigail LaFontan '20 (Political Science, CLAS)

Advisors: Marlene Schwartz, Professor, Human Development and Family Sciences; Matthew Singer, Associate Professor, Political Science

Supported by: CLAS Alan R. Bennett Honors Fund

Project Summary

Background: The federal government requires that every school district taking part in the Federal Child Nutrition Program have a written district wellness policy of how the districts will address: nutrition education, nutrition guidelines, physical activity, physical education, and parent and community involvement. Although many aspects of school nutrition are federally regulated, there are specific food-related practices that can only be regulated at the district level. Policies concerning these "district-led" practices often appear in the district wellness policy. This study focuses specifically on three topics addressed in district wellness policies: (a) Is free potable drinking water available to students throughout the school day? (b) Are Smart Snacks nutrition standards applied to food sold during fundraisers hosted during school hours? and (c) How do districts address unpaid student balances in the meal program? The aim of this study is to assess how a sample of districts addresses each of these issues in their written district wellness policies and in actual implementation.

Methods: Through analyzing district wellness policies from 34 districts in Connecticut using the coding tool, the WellSAT 3.0, this study seeks to describe the strength and comprehensiveness of the language of school nutrition policies. The research will be furthered in 4 of these districts through the use of interviews in order to see if there is a difference in the strength of nutrition policy language between districts and the implementation of those nutrition practices in the respective school environments.

Results: Most frequently, schools' practices are stronger than the policy language representing them; however, there were examples of practices in schools that were stronger, weaker, or on par with the written policy. Each of the 4 schools had a policy and practice to address nutrition standards for in-school fundraisers. Only one school had a policy to make water available throughout the entire school day, however each district's practice was strong. No school had a written policy to address unpaid student meal balances without stigmatizing the students involved, but each of the schools had strong practices.

Conclusions: Schools are implementing stronger practices than their written policies present. A school's written policy may not properly represent the strength of their practices.

Reflection on Learning

This is the largest project I have pursued, yet, and throughout this past year of work I have gained new, niche skills as well as important knowledge in the realm of school health. I learned hard skills, like how to use the WellSAT coding tool and how to structure an interview. I have also learned soft skills, like how to best manage my time, how to stay focused on repetitive tasks, and how to maintain communication with a large group of researchers. From the beginning to now, I have a much deeper understanding of the innerworkings of school health and wellness. I appreciate the importance of school policy for maintaining the voracity of student wellness. I also understand the school's role in government programs and district policies. Most of all, I have learned how vulnerable students are to nutritional habits. Our schools need to support student wellness in a wholistic manner by encourage beneficial habits in and out of the cafeteria. Students need to know where their food comes from, what it looks like before it is cooked, how they can prepare it for themselves, and how different types of people prefer different foods.

I will be attending law school in the fall and I have found that my work for this project has further inspired me to focus on food policy. I also have a new found interest in school law that I am looking forward to pursuing during law school.

Online Materials: <https://portfolio.com/entry/district-regulated-nutrition-programs>

Relationships Between Auditory Brainstem Responses & Timed-Sentence Comprehension

Anneliese Lapidès '20 (Biological Sciences & Human Development and Family Sciences, CLAS)

Advisors: Letitia Naigles, Professor, Psychological Sciences; Erika Skoe, Associate Professor, Speech, Language, and Hearing Sciences

Supported by: SURF Award

Project Summary

The goal of this project was to observe relationships between auditory brainstem response (ABR) and sentence comprehension in college students, answering the question: does complex sentence comprehension show a link with brainstem processing? This project addresses the need to study subcortical contributions to language comprehension in order to fully understand language processing, as most studies revolve around the cortex. Sentence comprehension was tested through completion of a task in which participants hear a sentence before being prompted to choose the correct match between two pictures. Twenty total sentences of four variously-complex types were randomly presented. Participants were monolingual English-speaking adults between ages 18 to 27 with normal hearing. They completed a hearing screening, the timed-sentence comprehension task, and a standardized vocabulary test. ABRs of each participant were recorded as they heard one-syllable sounds. Different components were analyzed to assess participants' wave repeatability in response to hearing the same sound and the ability to differentiate sounds. These measures were statistically tested along with participants' accuracy and reaction times in the timed-sentence comprehension task for correlations. Easier sentences resulted in higher scores and faster reaction times, with reaction time related to how well the brainstem processes different complex speech stimuli. By observing and quantifying individual variation, the findings demonstrate involvement of the brainstem in neural language encoding. This project informs future endeavors of the relationships between ABR measures and complex sentence comprehension. Moving forward, researchers can use subcortical assessments to study various aspects of language in different populations.

Reflection on Learning

After completing this project, I am better equipped with the skills necessary in the field of research, as well as learned specific skills such as the auditory brainstem response setup and methods, hearing screening methods, statistical analysis, and how to create a behavioral task using different programs. There were many times where I had to think quickly in order to troubleshoot so the study could carry on successfully. As a result, I have become a better and more efficient problem solver. Issues ranged from technical difficulties to fixing equipment and computer programs, but I was able to stay calm in order to resolve the issues without delaying the process or worrying participants.

Additionally, I have enhanced my critical thinking skills as well as become a more independent researcher. Running the study on my own with participants allowed me to build my confidence in the protocol and using the equipment I had been trained on. Training wise, my ability to run ABR, use sound-booth equipment, and use SPSS for data analysis has drastically improved. This project has given me the opportunity to fine-tune my time management skills. This helped ease the participant recruitment and thus the study to run smoothly. Completing my Honors thesis on this project allowed me to reflect on my project, engage with literature regarding this field, and greatly improve my scientific writing skills. Much of my experience can be related to ones I will have in the future as a physician. I was exposed to other fields such as SLHS and got to collaborate with people in this department that I otherwise wouldn't have had the chance to work with. In addition to working with people in a multidisciplinary team, interacting with human participants will help in the future when I interact with patients such as explaining what equipment was, the procedures we were going through, asking permission to apply electrodes, and making people feel comfortable in a new space. This experience expanded my appreciation for research, the difficulties that come with it, and challenging myself in a new environment. I am grateful for the unique opportunity that it gave me to pursue the research I have come to love here at UConn, and for providing me with skills that will make me a better physician in the future.

Online Materials: <https://portfolio.com/entry/auditory-brainstem-response-language-correlates>

University Support in the Feasibility of Public Health Programs: CT WISEWOMAN Medication Therapy Management (MTM) Program

Maria Latta '20 (Pharmacy Studies, PHR)

Advisors: Nathaniel Rickles, Associate Professor, Pharmacy Practice; Marie Smith, Professor, Pharmacy Practice

Supported by: SURF Award

Project Summary

Background:

The objective of this study is to evaluate the role of a university medication therapy management (MTM) support team in optimizing pharmacist delivery of MTM services to facilitate greater program feasibility and future sustainability. MTM is a service provided by pharmacists, which addresses medication adherence, gaps in therapy, medication education, and side effects. We will study the CDC funded Well-Integrated Screening and Evaluation for WOMen Across the Nation (WISEWOMAN) program, which provides MTM services to women who have high blood pressure, are low-income, and are uninsured by a multidisciplinary team of pharmacists, clinical health navigators, and prescribers.

Methods:

A mixed-methods approach was utilized to study communication, infrastructure, and team-based care. Quantitative analysis included the time taken for documentation after MTM sessions. Descriptive statistics were used for analysis. 9 interviews were conducted with pharmacists, clinical health navigators, project managers, and patients. Themes were identified using an inductive approach.

Results:

Time for documentation significantly decreased at each clinical site with the implementation of MTM support team. Pharmacists previously took an average of 9.9 days to input clinical documentation. With the university MTM support team, documentation took an average of 0.7 days (93% decrease). Previously, 38% of patient encounters were documented compared to 100% with university support. Professionals within the program reported that the university MTM support team improved communication, scheduling/completion of MTM session, and program feasibility. A variety of improvement ideas were shared.

Conclusion:

The university MTM support team improved practical aspects of MTM implementation including scheduling, building relationships, reminder to prioritize MTM sessions, and ensuring appropriate documentation. Another consistent theme was the need for improved patient recruitment strategies. Differences between communication style preferences demonstrate the need for the university MTM support team to consider site-specific needs and concerns. These results indicate that a university MTM support team is a viable solution for ensuring the successful implementation of state supported MTM programs. Future work will explore how the university MTM support team can improve recruitment approaches and facilitate expansion of the program to other locations across the state.

Reflection on Learning

I have gained so much from this research experience. Working closely with pharmacists and clinical health navigators, I grew as a health professional student. I learned about how to conduct myself in a professional workplace that relies on distance communication. This was my first experience with qualitative interview research and I realized the rich data that it can provide when conducting research related to patient and provider experiences. This research experience also helped me to realize that I have a passion for project management and community pharmacy. I want to pursue the intersection of community pharmacy and public health.

Online Materials: <https://portfolio.com/entry/frontiers-2020-poster>

The Association Between Adverse Parenting in Childhood and Later Symptoms of Oppositional Defiant Disorder or Antisocial Personality Disorder in Young Adulthood

Hannah Lavoie '21 (Psychological Sciences & Human Development and Family Sciences, CLAS)

Advisor: Jeffrey D. Burke, Associate Professor, Psychological Sciences

Project Summary

There are many categories of adverse parenting that can subsequently impact a child in later life, but can an absence of parental involvement and the presence of timid discipline predispose a child to a diagnosis of Antisocial Personality Disorder (APD) or Oppositional Defiant Disorder (ODD)? While the precise onset of APD and ODD are widely unknown, emerging literature has an increased focus on the relationship between these two disorders and how a child's environment (e.g., parenting) may play a larger role in a diagnosis than previous research suggests. In the current study, two aspects of adverse parenting are compared using data from the Developmental Trends Study (DTS). This longitudinal data set followed participants (n=177) from baseline, when the boys were between 7-12, until age 19 to quantify the behavior of the participants over time. Using this data set, the presence or absence of parental involvement, and timid discipline – a reluctance to initiate or persist in appropriate discipline – were tested as predictors of future ODD symptom counts through adolescence or APD diagnosis at age 18 or 19. It was hypothesized that lower parental involvement, or the presence of timid discipline, will predict increased ODD through age 17 and a diagnosis of APD at age 18 or 19. Results showed that while an increase in parental involvement predicted lower levels of ODD symptoms in adolescence and APD in adulthood, timid discipline was more predictive of ODD through adolescence, but was not a predictor for APD in young adulthood.

Reflection on Learning

Through interacting with the Diagnostic Trends Study (DTS) data set, I was able to enhance my knowledge on parenting practices and the adverse effects that negative parenting can have. I was able to quantify the correlation between adverse parenting behaviors (timid parenting and uninvolved parenting) and mental health diagnoses that became apparent in later life (ODD and APD). I learned that timid parenting is strongly correlated with an increase in the development of ODD in adulthood, and that parents that are more involved in their children's lives are less likely to have children diagnosed with ODD and APD as young adults. This data shows just how important a child's environment is when they are young. While the direct cause of both ODD and APD is unknown, myself, along with many other researchers in the field, are able to use the information gathered from these studies to begin to pinpoint adverse experiences that can aid in the development of these disorders. This research will help psychologists understand a link between a child's environment and their mental health in adulthood, and will help us hone in on the origin of these disorders.

In addition to what I have learned from my analyses, I have also learned a great deal about the research process and my own career goals. I have always wanted to pursue a PhD. in clinical psychology after I graduate, but working in the Behavioral and Affective Dysregulation Course and Outcomes (BADCO) lab, has helped me understand that I want to focus my graduate school research on adverse behaviors in children. I am hoping to pair my knowledge of behavior dysregulation with my drive to work with children with Autism Spectrum Disorders (ASD) in order to research specific adverse behaviors in children with ASD, and study the comorbidity of ASD and ODD in children. By having the opportunity to immerse myself in research in and outside of BADCO, I have not only gotten to experience producing research from start to finish, but I have gotten to help others with their projects to further aid in my understanding of completing literature searches and running participants.

I have gotten the unique opportunity to work in a team environment that has allowed me to inquire about and aid in the collection, analyses, and writing of research topics. I have been exposed to a variety of behavior-based research ideas to expand my understanding of where the field of psychology is today, and obtain a general knowledge on behavior dysregulation. I have learned a lot about collaboration, critical thinking, and the importance of time management in research, and I am learning more and more every day about the research process and how to best apply myself to the lab environment.

Online Materials: <https://portfolium.com/entry/how-parenting-impacts-the-presence-of-odd-and-apd>

Promoting Resilience in Self-Management (PRISM): Adverse Childhood Experiences and Impacts on Emotion Regulation

Kasey Macedo '20 (Psychological Sciences & Human Development and Family Sciences, CLAS)

Advisor: Beth Russell, Associate Professor, Human Development and Family Sciences

Supported by: SHARE Award

Project Summary

Adverse childhood experiences (ACEs), such as childhood abuse, neglect, and household dysfunction, can have lasting negative impacts on individuals including poor emotion regulation skills. Emotion regulation is the tendency to acknowledge and accept emotions, along with the associated behavioral response. Mindfulness based interventions can help individuals strengthen their emotion regulation skills by teaching emotional awareness and acceptance. The current study seeks to identify the relationship between ACEs and depression, as well as to examine the changes in emotion regulation skills among a sample of 13 adult participants that volunteered from the Cornerstone Foundation, a homeless shelter, food pantry, and community center, through the implementation of PRISM; PRISM is a mindfulness-based intervention that aims to strengthen emotion regulation skills among individuals by employing cognitive behavioral therapy components. The 13 participants completed PRISM in 2 waves, through four weeks of two-hour workshop sessions in a small-group format. The data collection of measures was conducted before and after PRISM's implementation. Results from this study indicate a significant relationship between ACEs and depression. Results also demonstrate significant improvements in depressive symptoms among PRISM participants. This study highlights the value of offering mental health support at places for vulnerable populations.

Reflection on Learning

As I reflect upon my thesis project, I am overcome with gratitude. Upon embarking on this journey during my third Undergraduate year, I was not aware of how this experience would impact me. In addition to the findings from this research, this project provided me with opportunities to grow personally, academically, and professionally.

While initially being comfortable with talking about my research was a task that I struggled with, I am now able to speak confidently and concisely about my work. Working with my faculty advisor, Dr. Beth Russell, helped me gain important skills; be it through challenging me to think more critically about a piece of literature that I was discussing or to utilize more academic language when speaking and writing, she has aided me in the development of my critical thinking, oral communication, and written communication skills.

In times of personal or academic related distress, despite how overwhelmed I felt, Dr. Russell showed me that I was capable of navigating through any hurdles thrown my way. Having Dr. Russell as an advisor, mentor, and a support system has made all of the difference.

Observing the implementation of PRISM allowed me to fully immerse my brain and heart into this project. While data certainly tells a story, as a visual learner, observation painted me the whole picture. Hearing people express how they struggled and seeing how PRISM helped them think differently about their distressing emotions over time, was the most gratifying part of this experience. While I will not be continuing research after graduation, I look forward to sharing moments of similar capacities with individuals in my future career.

I will be attending UConn's Graduate School for School Counseling beginning in the upcoming fall semester. Closing the chapter of my undergraduate and research career is bittersweet; however, I look forward to taking the knowledge and skills I have gained and using them as a School Counselor. Having gained a deeper understanding about the complex relationships between humans, their behaviors, and outcomes, as well as obtaining stronger professional and communication abilities, will allow me to be the most empathetic and diligent School Counselor that I can be. I am eternally grateful for the people, experiences, and skills that this thesis project has brought into my life.

Online Materials: <https://portfolio.com/entry/frontiers-2020-prism>

Empathy Influences Nonliteral Language Processing: Behavioral and EyeTracking Evidence

Pavitra Rao Makarla '21 (Cognitive Science, CLAS)

Advisor: Gerry Altmann, Professor, Psychological Sciences

Supported by: OUR Travel Award

Project Summary

Recognizing nonliteral language is a crucial part of communicative functioning and involves complex social cognitive skills such as the inference of mental states and empathy. To study the influence of empathy on processing literal positive, blunt, sarcastic, and jocular dynamic social interactions, we tracked healthy adults' eye movements while they watched video vignettes (N = 40). Participants were asked to evaluate speaker intention and friendliness, and we measured their empathy levels using the Interpersonal Reactivity Index (Davis, 1980). Behavioral results showed that participants with higher levels of empathic concern rated blunt interactions as less friendly compared to literal positive interactions, while participants with low empathic concern levels showed the opposite pattern. The eye tracking analysis revealed that all participants spent significantly more time looking at faces when scanning literal versus nonliteral vignettes. Moreover, participants with higher empathic concern showed significantly more fixations to faces when viewing jocular interactions compared to participants with lower empathic concern scores. Our findings will be discussed not only in the context of interactive versus modular nonliteral language processing theories, but also in relation to clinical populations who exhibit difficulties with empathy and nonliteral language understanding, (e.g., Autism Spectrum Disorders or Parkinson's Disease).

Reflection on Learning

By working on a project with researchers from both UConn (Dr. Jorgensen) and East Carolina University (Dr. Rothermich), both of whom are seasoned scientific researchers, I was able to get strong support at every step of this process. As this was the first time I was able to participate in both the writing part of the paper as well as helping with data analysis, I learned extremely valuable information about the research process that will assist me in my future research endeavors.

Brothers as Men: Masculinity, Homosociality, and Violence Among Fraternity Men

Daniel McCloskey '20 (Anthropology & Women's, Gender, and Sexuality Studies, CLAS), University Scholar

Advisors: Françoise Dussart, Professor, Anthropology; Pamela Erickson, Professor, Anthropology; Daisy Reyes, Associate Professor, Sociology

Supported by: UConn IDEA Grant

Project Summary

This project was a study that utilized both structured and semi-structured interview techniques to study ideas of gender, constructions of masculinity, aspects of homosociality and views of violence among fraternity men. There are four main conclusions from this research:

1. Participants have adopted a relaxed attitude towards gender expression and generally show weak gender ideology. While on the surface, this may seem progressive, I argue that it is truly an attempt to shield themselves from scrutiny regarding the hegemonic aspects of masculinity.
2. Masculinity is more complicated than just stereotypically hegemonic attributes. It also has an additive quality in which more feminine qualities are desirable and made masculine when performed by someone who already exemplifies the masculine ideal.
3. Existing theory rightly examines the ways that male homosocial institutions protect and transmit power. However, there is an element of emotional support and non-profitable friendship in these arrangements that is lacking for men elsewhere.
4. While the ways that power, dominance, and masculinity affect sexual violence are myriad, I also argue that commonly held ideas about the expectation of engaging in sexual activity while intoxicated and with intoxicated persons as well as the acceptability of this type of behavior form a pervasive aspect of rape culture that has yet to be fully addressed.

Reflection on Learning

This project was very difficult and very rewarding. In addition to collecting my data and writing my thesis, this project required me to transcribe hours of interviews, apply for grant funding, and shepherd a protocol through the IRB process. However, as difficult as this was, all of these experiences have been valuable and will serve me well as I continue my career in academia.

In addition to being my Honors Thesis, this project is my University Scholar Program project and has been supported by an IDEA Grant. I would like to thank all of the administrators that make those programs possible as well as my tireless advisory committee Dr. Françoise Dussart, Dr. Pamela Erickson, and Dr. Daisy Reyes.

Strain Response Shape Classification for Bridge Weigh-in-Motion Applications

Bartosz McCormick '20 (Civil Engineering, ENG)

Advisor: Shinae Jang, Associate Professor in Residence, Civil and Environmental Engineering

Supported by: Transportation Undergraduate Research Fellowship, USDOT

Project Summary

Due to their heavy load, trucks are predominantly responsible for the structural requirements of transportation infrastructure. Collecting data about these vehicles is important as it allows for improved load estimation for design, maintenance planning, and enforcement of vehicle load limits. Bridge Weigh-in-Motion (BWIM) systems are non-intrusive alternatives to the static weigh stations that are commonly seen on the side of highways across the United States. BWIM methodologies primarily utilize temporal strain data collected during the passing of a vehicle over a bridge to determine data such as gross vehicle weight, axle spacing, and axle weights. The performance of these methods is dependent on the strain response, the characteristics of which are dependent on vehicle weight and axle configuration. One of these characteristics is shape, which when identified serves as a high-level descriptor of the overall strain response. This research introduces a novel procedure for developing a 1-nearest-neighbor strain response shape classifier that is facilitated by the shape-based clustering of strain data. To demonstrate the viability and merit of the proposed procedure, strain data from a BWIM system installed on a highway bridge in Meriden, Connecticut has been evaluated. The results indicate that the classifier can successfully identify strain response shape. Additionally, as shape classification corresponds directly to physical truck characteristics, it can be used to effectively contextualize BWIM algorithm output during analysis.

Reflection on Learning

I first began pursuing this research in February 2019 when I joined Dr. Shinae Jang's Smart Infrastructure Lab. Over this time period, I got to become familiar with Bridge-Weigh-in-Motion (BWIM) by learning about it from a fellow student at the time. This allowed me to formulate my own research questions, which I ultimately pursued thanks to the Transportation Undergraduate Research Fellowship from the USDOT Center for Advanced Multimodal Mobility Solutions and Education. Going into the project, I was fairly proficient with the fundamentals of data science, however I had no experience with applying this knowledge to civil engineering applications. As BWIM research is very data heavy, this was the perfect opportunity to do so. I was able to greatly expand upon my knowledge of statistics and AI through the project by pursuing a highly specialized application of the subject matter. Treating entire sequences of data as single entries during classification was a unique challenge and it allowed me to research many innovative data processing techniques during my literature review. While ultimately, my knowledge of how the k-Shape algorithm functions may not be something I ever use again, the skills I developed through the learning process have translated entirely into my other academic pursuits. In fact, all parts of this experience will stay with me. As an underclassman, I didn't think I would become involved in research, but I'm glad I did as it turned into an integral part of my experience at UConn.

Online Materials: <https://portfolium.com/entry/bwim-strain-response-shape-classification>

A Diagnostic Electronic Circuit for Crosstalk Detection in Microelectrode Arrays

Morgan McNamara '20 (Biomedical Engineering, ENG)

Advisor: Martin Han, Associate Professor, Biomedical Engineering

Project Summary

One application of microelectrode arrays in the biomedical field is as implantable neuroprosthetics, which offers promising solutions to neurological disorders and spinal cord injuries. However, issues such as degradation over time and insulation failure can cause current leakage, or crosstalk, between channels of microelectrodes. This can lead to misleading detection of neural signals. In this research project, a diagnostic circuit for crosstalk detection has been developed based on a single printed circuit board (PCB). This device has the capability of recording data for up to 32 channels of microelectrodes. In order to provide data that is relevant to neural prosthetics for electrical stimulation, our design utilizes constant-current or -voltage pulses.

The goal of this research project was to assemble and test the PCB. Approximately 260 components were soldered onto the PCB and were tested to ensure that they were working properly. After the assembly and testing were complete, an in-vitro experiment was performed. Four electrodes were set up in a phosphate-buffered saline (PBS) solution. The circuit successfully generated current stimulation waveforms and measured the voltage transient signals on the stimulated electrode. Crosstalk voltage signals of the adjacent electrodes were collected using an oscilloscope, and quantified offline. In future work, a recording element will be used to acquire data and directly transfer to a computer interface. The circuit provides a cost-effective and efficient method for multi-channel neural stimulation and crosstalk detection that can be used to further research in collaborating labs.

Reflection on Learning

Conducting this research project has expanded my knowledge on neuroprosthetics and neural stimulation. One of the most valuable skills that I have acquired throughout this process is the ability to problem solve and work independently. When it comes to developing and testing circuits, knowing how to troubleshoot is an extremely important skill. This project also required me to learn many new technologies and software programs. The knowledge and skills that I have acquired will be useful in my future endeavors in the biomedical engineering field.

Noise-Induced Stabilization of Hamiltonian Systems

Daniel Meskill '21 (Statistics & Mathematics, CLAS)

Advisor: Tiffany Kolba, Associate Professor, Mathematics and Statistics, Valparaiso University

Supported by: OUR Travel Award

Project Summary

Noise-induced stabilization is the phenomenon where a system of ordinary differential equations is unstable, but by adding randomness, its corresponding system of stochastic differential equations is stable. It has been proven that unstable Hamiltonian systems cannot be stabilized by adding constant noise, where global stochastic boundedness is our notion of stability. In this study, we investigate adding nonconstant noise to two classes of Hamiltonian systems to achieve noise-induced stabilization. Our method for proving noise-induced stabilization consists of constructing local Lyapunov functions on various subsets of the plane, and then smoothing them together to form a global Lyapunov function defined on the entire plane. We also pursue the minimum noise necessary for stabilization of these systems.

Reflection on Learning

This past summer I was part of a mathematics REU at Valparaiso University in Indiana. I learned the research process, how to research in a group, how to give academic talks, and how to write a paper for publication among other things. I also got bit by the research bug. I had such an enjoyable time researching in Indiana that I cannot wait to move onto a new research project. To put it bluntly, I learned a lot. We achieved two major results with our paper currently in the process of being published. Overall, I thoroughly enjoyed my time researching mathematics and look forward to my next research experience.

Molecular Dynamics Modeling of Zein Protein

Oreoluwa Olowe '21 (Mechanical Engineering, ENG)

Advisor: Anna Tarakanova, Assistant Professor, Mechanical Engineering

Supported by: Work-Study Research Assistant Program

Project Summary

Zein is an alcohol-soluble protein in corn. Zein is being used as a possible replacement for petrochemical products and a common component used in the manufacture of plastics, paper coatings, adhesive and shellac. Zein are stored in the rough endoplasmic reticulum (ER)-derived protein bodies, which results in the formation of the endosperm. Zein was first discovered from the byproduct of starch and oil during the wet milling process. Zein can be classified into four major groups: α , δ , β , and γ . Researchers have developed Experimental and Computational Methods to define the overall structure of Zein. Using Fourier Transform Infrared Spectroscopy (FTIR), Circular Dichroism, Small-Angle X-Ray Scattering (SAXS) and X-ray Diffraction Solubility. Zein is about 72% α -helix, 15% turn and 9% β -sheets. Solubility of Zein is also being researched with protein modelling and simulations programs like Modeler and Gromacs. More research is being done to make Zein more soluble in water.

Reflection on Learning

I learned how to navigate through unknown information to find what I need to solve a problem. I developed efficient time management skills.

Genetic Components Controlling Flower Size

Lisa Olsen '20 (Molecular and Cell Biology, CLAS)

Advisor: Yaowu Yuan, Associate Professor, Ecology and Evolutionary Biology

Project Summary

Flowers exhibit tremendous diversity in many traits, including their size, which is a key factor in reproductive success and evolution. In addition to interspecific flower size variation, many species have significant intraspecific differences in flower size. The aim of this study was to identify the genetic components involved in controlling flower size. To understand flower size variation, we looked at two species from the classic model system *Mimulus*. We analyzed a crossbreeding between the small *Mimulus parishii* flower and the closely related large *Mimulus cardinalis* flower. Our work suggests a gene on the seventh chromosome, near the six hundredth nucleotide, is a major component in flower size control. Identification of this gene advances our understanding of genetic controls of flower size, which in turn improves our understanding of mating system evolution and fitness.

Reflection on Learning

Flower size is an extremely important characteristics in flowers as it influences plant-pollinator interactions and the flowers' reproductive success. Through my study, we found a gene location that is a major factor in flower size control and will help future researchers learn more about the genetic controls of flowers. This study has taught me valuable research techniques that will help me further my educational and career goals.

The Contradictions of Female Body Ideals: Body Image Workshops for Women of Color

Chineze Osakwe '21 (Political Science & Human Rights, CLAS)

Advisor: Kathy Fischer, Associate Director, UConn Women's Center

Supported by: UConn IDEA Grant

Project Summary

My IDEA Grant Project was to design and pilot body image workshops for two target female communities on campus: Latinx and African American. The overall question I sought to answer was how much of a direct or indirect influence Euro- centric values and beauty standards had and continue to have on body image ideals in African American and Latinx communities. The first goal of my project was researching the Euro- centric perception of beauty in and outside of the US. It was important for me to understand the trends and beauty fashions that have occurred for White women throughout history, to determine if there are any parallels in beauty trends between European nations and communities of color in the US. Secondly, I constructed body image workshops that illuminated the various historic origins and modern-day influences on body image. My goal in creating these body image workshops was to hone in on the influence that "whiteness" has had on the two communities. Moreover, the workshops probed the additional agents that have shaped beauty standards among the different ethnicities and groups of people within the same racial community.

Reflection on Learning

I believe that there were aspects of my project that were successful, and other goals that were not adequately met. Research- wise, I found insurmountable information discussing the relationship between beauty ideals dating back to European colonization and present day beauty standards in communities of color. The articles I read illustrated that European colonization created racial hierarchical systems which in turn juxtaposed whiteness to blackness in every regard. Therefore, this juxtaposition determined that whiteness (and lighter skin) would equate to beauty, while darker skin would not. Although I had some background knowledge in the origins and influence of colorism on beauty standards in communities of color, my in- depth research yielded information that had never even occurred to me. For instance, although I was aware of the natural hair movement in the US dating back to the 1970's, I did not know that this movement had transnational significance. My research indicated that not only did the Black is Beautiful Campaign in the US draw its inspiration from the hair styles of women in Africa, but it sought to represent the various countries and cultures that contributed to "Black pride" globally.

As a woman of color, I found the content of my research to be both disheartening and inspiring. By this I mean, that although colorism, the sexualization of women and girls of color, and cultural appropriation are not uplifting topics of research, the resistance and reconstruction of beauty standards by women of color is truly inspiring. I found that during the workshops, we were able to balance the negative with the positive by highlighting the malities in our society, but illuminating the movements and practices that developed in opposition. The workshops were useful insofar as participants were able to probe controversial and uncomfortable topics in a small, intimate setting, without fear of judgment. Although many of us had similar views on a particular issue, various perspectives were divulged, creating a more bountiful and less redundant conversation.

The one area of my project that did not adequately fulfill my expectations was the recruitment process. Although I attempted various methods and mediums to attract participants, the turn- out was very small. This was disappointing, seeing as the answers to some of my research questions may not adequately reflect the population. For instance, I wanted my workshops to probe whether people who comprise the same racial group face distinct societal and familial pressures due to their ethnicity, religion, or background; while simultaneously all facing the issue of conforming to the Euro- centric beauty ideal. This was the one aspect of my workshops that I wish we had touched upon, but failed to do so.

Regardless, I found our conversations to be beneficial to me as a research and woman of color. A majority of participants disclosed that the workshops use of past and present day influences on body image complimented one another. Furthermore, I believe that in drawing parallels between different time periods in history, participants

realized that the struggle to fulfill beauty ideals is not one that they alone are facing. Rather, women have dealt with this for as long as we can remember, but have defied and revolutionized these standards by coming together and discussing them, similar to what has been done in these workshops.

Online Materials: <https://portfolium.com/entry/the-contradictions-of-female-body-ideals>

Characterization of a Mycoplasma Pneumoniae CARDS Toxin Mutant

Nikaash Pasnoori '20 (Pathobiology, CAHNR)

Advisor: Steven Szczepanek, Assistant Professor, Pathobiology and Veterinary Science

Supported by: OUR Supply Award

Project Summary

Mycoplasma pneumoniae is a high-burden pathogen which causes mild to significant infections of the respiratory system. According to the CDC, an estimated two million cases occur yearly in the United States alone, demonstrating the widespread effect of the pathogen. In addition to being the cause of respiratory infections, *M. pneumoniae* has also been implicated in exacerbating pre-existing asthma conditions. These morbidities make finding a vaccine candidate a vital part of easing the healthcare burden caused by the pathogen. The current mechanism of infection is unknown, but recent evidence points to the Community Acquired Respiratory Distress Syndrome (CARDS) toxin as being involved in that mechanism. We believe that if a mutant was created that was attenuated for the CARDS toxin, then the virulence will be diminished. This will provide further evidence to the theory that the CARDS toxin is responsible for the pathogenesis of the bacteria.

In this experiment, we isolated a *M. pneumoniae* mutant and placed it in a mouse model to test for virulence. After using transposon insertion to find a possible mutant, polymerase chain reaction (PCR) was run to confirm the insertion of the transposon. The mutant was then placed in a mouse model to compare its virulence with that of wild-type *M. pneumoniae*. When placed in the model, the mutant *M. pneumoniae*-infected mice had lower lesion scoring and lower bacterial counts in serial dilutions than those of the wild-type *M. pneumoniae*. This gave proof that the isolated mutant was in fact attenuated for virulence. Further steps must be taken to ascertain the identity of the mutant, such as DNA sequencing and in vitro studies. Given the results, this experiment was a success in isolating a virulence-attenuated *M. pneumoniae* mutant, and is a step closer to finding a possible vaccine for the disease.

Reflection on Learning

Participating and completing this project showed me how to effectively plan different steps in the research method. For example, I learned how to effectively set up a hypothesis, design an experiment with clear independent and dependent variables, and interpret complex results. COVID-19 interrupting this research also showed me how to plan ahead, and what steps to take for future researchers to carry out. Because I am a senior and graduating this year, I hope another undergraduate will be able to take this work and continue it, furthering scientific thought from one person to the next.

Online Materials: <https://portfolio.com/entry/characterization-of-mycoplasma-pneumoniae-mutant>

Low Reported Cyberbullying in Patients Due to Varying Perceptions

Monitha Patel '20 (Molecular and Cell Biology, CLAS)

Advisor: Sharon Smith, Adjunct Professor, Molecular and Cell Biology

Supported by: OUR Travel Award

Project Summary

Rises in modern technology have increased adolescents risk of being cyberbullied or cyberbullying another teen. This project aims to determine the prevalence of cyberbullying among adolescents presenting at the Emergency Department at Connecticut Children's Medical Center. The project also aims to determine parental involvement in monitoring use, texting activity, and social media use.

Reflection on Learning

This project taught me that modern technology provides a wide variety of social media platforms and adolescents are not aware of what is considered on cyberbullying on these platforms.

Online Materials: <https://portfolium.com/entry/low-reported-cyberbullying-in-patients-due-to-vary>

How We Study Reading: Affordances and Limitations of RSVP and Naturalistic Reading Paradigms

Shyam Patel '20 (Physiology and Neurobiology, CLAS)

Maria Sol Anyosa '20 (Psychological Sciences & Human Development and Family Sciences, CLAS)

Advisor: Nicole Landi, Associate Professor, Psychological Sciences

Project Summary

Rapid serial visual presentation (RSVP) and Naturalistic reading paradigms are two of the most popular paradigms used in neuroimaging studies of reading. In RSVP experiments single words or phrases are presented on screen one at a time before quickly being replaced by the next word/phrase. In naturalistic reading tasks bodies of text are presented and participants read at their own pace and their eye movements are tracked. While both of these methods are used, literature comparing them is sparse. Our research is examining the affordances and limitations of each paradigm in order to better understand their strengths and weaknesses.

In this review of RSVP and naturalistic reading paradigms, we conclude that while RSVP affords more control over stimuli and what participants are reading it is difficult to get readers to form a text model. This method is also quite different from how we typically read and thus lacks ecological validity. In naturalistic reading paradigms, readers more easily construct text models making this a good way to study comprehension. However, with these paradigms it is difficult to determine what a reader is focusing on or processing at any given time (even with eye tracking). Challenges with stimulus design for each and subtractive methods also complicate any direct comparisons. We suggest that further work comparing brain activation in sentence-based RSVP experiments to that observed with naturalistic reading tasks and studies designed to verify in vs. out of scanner eye-tracking will help us to better understand and compare these paradigms.

Reflection on Learning

During the preparation of this project, I learned how the two different reading paradigms were implemented in current studies and the different methodologies between the two paradigms. This is important to look at how the paradigms can impact the research that is conducted and see the difference that one paradigm can make over another, as well as seeing which paradigm is better suited for differing tasks.

I have been involved with research for about two years now, working to administer reading tasks to children with the fMRI scanner at UConn Brain Imaging Research Center, along with gaining training for the administration of EEG and behavioral tasks to children. I have had the opportunity to meet some great people through these experiences and been able to develop my communication skills and learn more about what it means to be a part of a team.

Online Materials: <https://portfolio.com/entry/affordances-and-limitations-of-reading-paradigms>

Context-Sensitive Speech Perception: Lexically-Mediated Compensation for Coarticulation

Giovanni Peraza-Santiago '20 (Psychological Sciences, CLAS)

Keia'na Beeson '20 (Psychological Sciences, CLAS)

Advisor: James Magnuson, Professor, Psychological Sciences

Supported by: PCLB Psychological Sciences Undergraduate Research Grant

Project Summary

Lexically-mediated Compensation for Coarticulation was a paradigm created by Elman and McClelland (1988) that seemed to prove top-down knowledge integrates acoustic information via a feedback loop. When listeners hear ambiguous speech sounds with a front place-of-articulation (/t/,/s/,/d/, etc.) in the context of a word they seem to compensate for coarticulation and attribute ambiguity to the speaker trying to reach a speech sound with a back place-of-articulation (/k/,/r/,/g/, etc.). Elman and McClelland took this a step further by providing evidence that lexical context could be used to predict in what direction (front or back) the compensation would take place. However, evidence displaying this phenomena in past research has proven inconsistent (McQueen et al., 2009; Pitt & McQueen, 1998). The method to replicate ICfC requires context stimuli that end in ambiguous phonemes with front-back PoA (place-of-articulation) followed by a target stimuli with an ambiguous front-back PoA.

Participants select which PoA they heard from the ambiguous target sound. Our hope is that we are able to successfully replicate Elman and McClelland's study and conduct the most comprehensive ICfC study to date. We plan on doing this by decreasing our variability as much as possible through a dramatic increase in the number of participants, front-back contrasts, and overall lexicon. The results of this study will give us key insight in the infrastructure of the human speech processing system, and a better understanding of age-related changes in speech perception where decline is expected to induce a greater reliance on top-down processing.

Reflection on Learning

Giovanni Peraza-Santiago: Being able to engage collaboratively in an academic environment and go through the steps of creating one of my first research studies was my biggest takeaway from this experience. I loved engaging myself with the nitty-gritty and the small details that factor into creating an experiment. From an undergraduate's perspective you almost never see the type of work and hard hours that go into creating these world-changing theories and concepts. This opportunity allowed me to peek inside the life of a researcher and experience first-hand about what goes on in the day-to-day. Immersing myself in this type of environment also allowed me to gain new skills that I never thought I would learn. I learned how to edit speech soundwaves using softwares like Praat and how to morph separate speech signals into continua for our stimuli—which took hours to complete but somehow managed to never stop being so satisfying. I even learned seemingly insignificant basic computer skills like navigating and learning the basics of MacOS terminal.

This project also introduced me to the programming world. Dr. Magnuson along with many of the graduate students I had the pleasure of working with told me all about Python and R studio and the benefits of statistical programming. Through their guidance I was able to start teaching myself how to program on my spare time which is an absolutely valuable skill to have. It's not hyperbole when I say this project has changed what kind of career path I want to take in life. My experiences have made me realize the importance of learning statistical programming and how transferrable these skills are to any career involving research gathering and data analysis. All and all, this project has had a huge impact on my senior year and has given me the opportunity to learn new skills all the while collaborating with great people.

Keia'na Beeson: I have enjoyed my time working with the team in the Mag-Lab from the start. Learning about human language and information-processing in such a hands-on way has been an invaluable experience that has really transformed my outlook on the world. Exploring the complexities of the human mind with such a diverse and collaborative group of thinkers has allowed me to really develop my cognitive approach to life and think in an abstract and holistic way. I look forward to continue applying these skills and education through my work in behavioral therapy with children with developmental delays.

Analysis of Per-fluoroalkyl Substances in Drinking Water Utilizing EPA 537.1

Slawomir Piela '23 (Chemistry & Marine Sciences, CLAS)

Isabella McGrath '23 (Environmental Sciences, CLAS)

Christopher Vaquero '23 (Biomedical Engineering, ENG)

Advisors: Anthony Provatas, Academic Assistant II, Center for Environmental Sciences and Engineering; James Stuart, Senior Research Scientist, Center for Environmental Sciences and Engineering, and Professor Emeritus, Chemistry; Christopher Perkins, Academic Assistant II, Center for Environmental Sciences and Engineering

Project Summary

Perfluoroalkyl acids (PFAAs) are a group of synthetic, amphiphilic compounds belonging to a larger class of compounds also called perfluoroalkyl substances (PFASs). PFAAs are used in a variety of consumer products that require water and lipid resistance, such as food packaging, non-stick cookware, waterproof clothing, stain resistant fabrics, and as surfactants. They contain a hydrophilic acid head group and a hydrophobic fluorocarbon tail, which assist in the mixing of typically immiscible phases. PFAAs are extremely stable and resistant to degradation due to the strength of the carbon-fluorine bonds. However, PFAA concentrations in the environment, specifically drinking water, are very low. Thus a rigorous method of analysis must be developed and implemented to analyze such minute concentrations.

The main objectives of this study were the refinement of sample preparation and technique to develop a Standard Operating Procedure(SOP) for analyzing PFAA concentrations in drinking water. Samples were extracted using polystyrene-divinylbenzene cartridges and analysis was performed using UPLC-MS/MS. Particular attention was paid to minimizing PFAA contamination that stemmed from preparation and instrumentation. Analysis was validated by a method detection limit study and a precision accuracy study. The MDL study indicated good analyte sensitivity and recovery ranging from 74.0-128.0% and standard deviation up to 0.001. The PA study indicated excellent sample sensitivity and recovery ranging from 83.7-114.2% and standard deviation up to 0.002.

Reflection on Learning

An efficient and robust method for the detection of PFAAs was developed that had high sensitivity and accuracy. Despite dealing with a difficult compound to analyze, the necessary instrumental parameters and preparation techniques were refined to provide optimum results. Additionally, sources and areas of contamination were identified and mitigated.

Online Materials: <https://portfolio.com/entry/analysis-of-pfaas-in-drinking-water>

Evaluating the Creative Process and Identifying Best Practices of External Project-Based Learning on Undergraduate Design Students

Paula Plaza '20 (Digital Media and Design, SFA; Psychological Sciences, CLAS)

Advisor: Philip Dwire, Assistant Professor in Residence, Digital Media and Design

Project Summary

This is a qualitative study of the creative process in which undergraduate design students work with real-world clients. There is a lack of information on the practices of external project-based learning in university settings. The project intends to highlight the fundamental steps of the process, healthy client relationships, and efficient team habits utilized to maximize efficiency. Utilizing a personal-observation method, it analyzes the obstacles and benefits of external project-based learning on this particular sample group during the Fall 2019 semester at the University of Connecticut, Stamford campus. The group of five worked with the Maritime Aquarium in creating a product that would expand its target audience as well as re-engage its current customers. The creative process showed a high dependency on group dynamics and team efficiency. Team objectives were crucial in accomplishing overall project objectives, and ran parallel to them. As a result, beneficial practices revolved around teamwork.

Reflection on Learning

Writing about the creative process and best practices of Agency was a unique challenge. It forced me to go beyond my comfort zone of traditional research papers and helped me become a reporter of first-hand information. I feel more confident with myself and in my abilities as a leader as well as a team member. Within the first semester, I utilized the personal-observation method to acquire valuable insight on the external project-based learning process. As an active participant, I obtained direct experience in identifying key behaviors to optimize teamwork in order to enhance the learning process. I learned to be a primary source. Subsequently, being a member of a team gave me the opportunity to identify my own constructive or detrimental behaviors in an attempt to maximize team efficiency. I became a better leader and project manager as a result of the process. The second half of the semester was mostly based on retrospection and my personal reflection on the process of working with a real client in an academic setting. It gave me the opportunity to expand my networks and improve communication skills. I believe this experience proved to be beneficial. I have become aware of my contributions to a team as well as the positive behaviors that make these types of projects run smoothly. Furthermore, I believe that this project can encourage other universities that practice external project-based learning to share their insight and methods.

Online Materials: <https://portfolium.com/entry/reflection-on-the-creative-process-of-dmd-agency>

My Dear Little Mother: A Puppetry Retelling Of A Lost Correspondence

Esme Roszel '20 (Puppetry, SFA)

Advisor: Bart Roccoberton, Professor, Puppetry

Supported by: UConn IDEA Grant

Project Summary

"My Dear Little Mother: A Puppetry Retelling of a Lost Correspondence" is a one-hour puppetry production, inspired by a box of letters written by a Canadian soldier to his mother during the First World War. Based in truth, the show will bring to light the experiences of a single mother on the home front, as well as address the complexities of grief and loss.

The production will involve large scale puppets as well as shadow puppetry, and will feature a score of original music. This production is appropriate for ages 13 and up.

Reflection on Learning

Though this project still has yet to come to fruition, I have learned a great deal about the process of creating a puppetry production on my own. It has been an incredible learning opportunity to engage in a production by writing, fabricating, managing rehearsals, and telling a story that is of great importance to me. Though the project is currently at a standstill with the current state of the world, I am all the more inspired to bring this work to an audience of people affected by loss on a global scale.

Online Materials: <https://portfolium.com/entry/my-dear-little-mother>

An Exploration of wdr73's Effect on Left-Right Patterning in Zebrafish

Fabio Saccomanno '21 (Molecular and Cell Biology, CLAS)

Advisors: Kenneth Campellone, Associate Professor, Molecular and Cell Biology; David Daggett, Assistant Professor in Residence, Molecular and Cell Biology

Supported by: SURF Award

Project Summary

Kupffer's Vesicle (KV) and its role in the Left-Right patterning process has been extensively studied as the "ciliated embryonic organ of asymmetry" in zebrafish. L/R patterning is the process by which internal organs assume the correct orientation and location during development. Wdr73 is a gene implicated in Galloway-Mowat Syndrome (GMS), although the mechanism is still poorly understood. Some of the phenotypes of GMS are consistent with a broader class of disorders known as ciliopathies, resulting from abnormal cilia formation or function. I hypothesize that wdr73 is required for proper L/R patterning.

A late-stage injection technique targeting precursor cells to KV was used to evaluate gross KV formation. Embryos were injected with morpholinos (MOs) to block expression of specific genes. Embryos not expressing wdr73 generated KVs that grossly appeared normal. Embryos not expressing ntl and fss were used separately as positive and negative controls. Results were quantified. Further experimentation was completed using in-situ hybridization to qualify and quantify the direction of cardiac tissue looping in developing embryos. Inhibiting expression of wdr73 was found to significantly alter looping compared to controls. Separately inhibiting expression of ntl and fss was similarly used for positive and negative controls.

I am currently evaluating if wdr73 plays a role in ciliogenesis by observing and qualifying KV cilia using fluorescence microscopy. With embryonic organs like KV found across vertebrates and wdr73 implicated in a rare disease, identifying the relationship between the two is of paramount importance to improve the quality of life for human patients.

Reflection on Learning

Earning a SURF grant was an incredible opportunity to softly wade into research. Prior to receiving this grant, my research experience was limited to a lab class that I took during my third semester. My research experience has since become something I am confident about and proud of.

This experience has taught me much more than the project I investigated. I learned how to produce zebrafish embryos, how to feed them, how to mix solutions, and all the other important aspects that were necessary in making my project possible. Learning to understand these processes was the most enlightening part of the experience. Furthermore, the degree of independence I assumed by working over the summer was not something that I previously experienced; aside from weekly lab meetings, I was solely responsible for holding myself accountable to complete the project. This meant ensuring that I had enough materials to work with in addition to all the other secondary responsibilities like turning off the nitrogen gas and closing the door behind me.

Regarding my project specifically, I accomplished most of what I initially sought to complete. In my original outline for the summer, I aimed to complete immunofluorescent analysis of cilia within KV. I am still working on it nearly one year later! However, I am confident that my results from the summer show that wdr73 affects L/R patterning somehow, and this somehow is what I am working to define. In addition, I have learned much more than I ever expected about zebrafish as a model organism and the surrounding literature concerning ciliopathies and L/R patterning. Working on this project has enabled me to begin my research career and I am enormously thankful to the Office of Undergraduate Research, Dr. Ken Campellone, and especially Dr. David Daggett for the opportunity and for their invaluable guidance.

Online Materials: <https://portfolio.com/entry/wdr73s-effect-on-lr-patterning-in-zebrafish>

An Archaeological Study of Human Hunting Adaptations at Wadi Madamagh, Jordan during the Last Glacial Maximum

Srishti Sadhir '20 (Ecology and Evolutionary Biology & Anthropology, CLAS), University Scholar

Advisor: Natalie Munro, Professor, Anthropology

Project Summary

Wadi Madamagh, situated in the southern Levant, was occupied during the Last Glacial Maximum (LGM; 26,500-19,000 years ago). The climate and environmental conditions of this event are reflected in the faunal assemblage, which is drawn from two distinct cultural periods, the Late Upper Paleolithic and the Early Epipaleolithic. To examine human hunting strategies and patterns of site occupation, I employed zooarchaeological methods and a human behavioral ecology framework. Both taxonomic and skeletal representation reveals that humans at Wadi Madamagh predominantly hunted wild goat (*Capra aegagrus* and *Capra ibex*) and returned with whole carcasses to the site. Due to their large-body size, wild goats are highly ranked, and given high abundance on the landscape, they were efficient targets for hunters. Mortality profiles reveal that humans targeted the prime-aged individuals in the herd, further reflecting an efficient hunting strategy. The presence of both bezoar goat (*Capra aegagrus*) and waterfowl indicates that the region was wetter than today and that wetlands were located in the vicinity of the site. Compared to contemporaneous sites in the region, the focus on wild goats is unusual, but given the suitable rocky landscape around Wadi Madamagh, it is not surprising. Unlike some Mediterranean sites, the rarity of small game at Wadi Madamagh indicates that human hunters were able to rely nearly exclusively on wild goat populations for meat and did not need to shift down to small game resources. In combination with other markers of site occupation intensity, the faunal assemblage suggests that Wadi Madamagh was home to repeated, light occupations over the course of millennia.

Reflection on Learning

My Honors and University Scholar project reflects nearly four years of work spanning all research phases of an archaeological assemblage: cleaning and sorting material, identifying specimens, conducting analyses, and writing a thesis and academic publication. As such, this project was a unique opportunity for me as an undergraduate student because I was involved in all stages of research and engaged quite thoroughly with the assemblage and associated literature. This experience has taught me how to be a researcher, especially how to collect, interpret, and communicate scientific data effectively. These are skills that I will directly transfer to graduate school next year and to a future research career.

Feasibility of Using a Private Facebook Group to Promote Healthy Feeding Practices in Parents of Toddlers

Kesan Samuel '20 (Biological Sciences & Human Development and Family Sciences, CLAS), LSAMP Scholar

Chelsea Piccirillo '23 (Environmental Engineering, ENG)

Advisor: Valerie Duffy, Professor, Allied Health Sciences

Supported by: Work-Study Research Assistant Program

Project Summary

This research study involved creating and monitoring a secret Facebook group to reach low-income families with toddlers to share evidence-based feeding recommendations. There were 20 low-income families recruited from a single community. Our team translated recommendations to simple messages on limiting sugary drinks, promoting healthy snacks and practicing responsive feeding. We formed weekly posts with these messages, recipes for family meals, and questions to encourage interactions. The messages were visually appealing with catchy and concise content to encourage parents to implement healthy toddler feeding practices. The recipes chosen were coordinated with weekly sales at nearby grocery stores. Parent engagement was measured on whether posts were viewed, liked or commented. The most engagement was responses to open-ended questions when parents were asked to talk about their children. The parents also had a higher rate of response when they were tagged in a post about toddler feeding recommendations. The results of this pilot study can help identify the ways to engage families in evidence-based toddler feeding recommendations and encourage information sharing in an engaging format.

Reflection on Learning

Kesan Samuel: Through this research project, I learned how to effectively communicate nutritional health information by translating scientific research into simple messages. I learned about the process of creating and monitoring a private Facebook group and evaluating the engagement of research participants. In addition, I developed my creative and critical thinking skills by designing visually appealing content and using autonomy supportive prompts to encourage healthy feeding practices. This project has helped me to better understand how social media interventions can be used for health promotion.

Using the ADAPT-ITT Model to Implement a Low Impact Health Behavior Intervention for Adolescents in Two School Based Settings

Jessica Serrao '20 (Allied Health Sciences, CAHNR)

Advisor: Valerie Duffy, Professor, Allied Health Sciences

Project Summary

Background:

We have shown that a low-impact behavioral intervention can motivate willingness for children to improve diet and physical activity behaviors in a clinical setting. We aimed to adapt this low-impact intervention to a school setting in alignment with school meal programs and wellness activities.

Methods:

The ADAPT-ITT model (Wingwood & DiClemente, 2008), provided an 8-phase theoretical framework to adapt an online tailored health message intervention to two Connecticut middle schools, one of which was a Title 1 school. Students engaged in a brief, behavioral screening (pediatric adaptive liking survey, (PALS). This self-report assessment was further modified based on stakeholders perceived concerns to include evaluations of sleep habits as assessed through a Pediatric Daytime Sleepiness Scale (PDSS). Algorithms were programmed to deliver 2-3 tailored health messages based on the PALS responses in conjunction with 2 general messages concerning drinking water and reducing food waste. The acceptability and feasibility of the survey and evidence-based intervention were analyzed through questions at both school locations.

Results:

All phases were completed in the first school, while in the Title One school due to the COVID-19 outbreak the study was halted at Phase 6. In the first school, 202 responses (53% male) were recorded. 74% of students indicated they were not hungry for breakfast. While 67% reported not liking what was being offered each day for lunch. Food insecure households in the first community make up 16-29% of households, significantly greater than the national average. In the Title One school 311 responses (49% female) were recorded. 20.3% of students had a score of 22 or greater indicating daytime sleepiness. The largest contributor to lack of sleep was screen-time with 62.6% of students indicating that they take a cellphone or tablet to bed with them everyday. Vegetable food waste in September correlated with reported dislike (36% wasted). By November, this improved to 9%. Overall, more than 70% indicated that the survey made them think about what they eat and do.

Conclusion:

The ADAPT-ITT framework guided the adoption of this low-impact behavioral intervention in two separate middle schools, allowing relevance and acceptability to the school stakeholders. More than 75% of students at both schools indicated that the messages helped them learn something new about food and nutrition. Greater involvement with parents was necessary.

Reflection on Learning

By engaging with this project through the Allied Health Sciences Department I learned a great deal about school meal programs and food security. The two schools that I worked with were in Windsor and East Hartford CT. Given the proximity to UConn, I was under the impression that these schools would reap the benefits of the great minds produced by the University. However, through my research I've learned that a lot of the communities in Connecticut are suffering. The wage gap is very high throughout the state and the job market is dim. Due to these circumstances many of the families qualify for free or reduced meals through Medicaid or simply because of the band of income into which they fall. I was surprised to learn of just how many of the communities within Connecticut have schools that as a whole school qualify for free or reduced meals due to the large percentage of students (40%). Beyond my research I spoke with my friends who also work in local schools as student teachers to gain their perspective. They witnessed many of the same things in their schools. With the current COVID-19 crisis many schools are faced with the challenge of delivering food to these students, as they know that families aren't able to put meals on the table. It was heartbreaking and astonishing that in our backyard so much suffering and disparity was occurring.

As part of the survey my team administered, we asked students questions regarding their perceived food security. The responses at East Hartford were to be expected given that the school is categorized as a Title One School, which means that large majority of students are low income and therefore the school receives federal funds to supplement the students' educational needs. However in Windsor, a greater percentage than anticipated (16-29%) felt worried that they would not have enough food or did not eat enough because food was not available. Through collaboration with the Windsor Hunger Action Team (HAT) we worked to improve participation in school meals, increase backpack meal programs and increase food pantry options. The research in Windsor was so important that we brought it to a HAT regional conference where members of HATs across the state learned of the efforts. At this conference, I had the opportunity to meet CT State Senator Anwar who has had an inspiring career as a doctor and now state senator helping to alleviate the problems CT faces.

This research overall, armed me with a lot of real world experience and knowledge. With regards to data analysis I've picked up skills in SPSS, SAS, and Excel. In addition, I have learned to create stakeholder reports, integrating data and sharing concerning results with the community. More importantly however, I have learned a great deal about myself and what I am passionate about. When I joined this project I was keen on becoming a doctor because I knew I wanted to be in the health field but I thought I would be most valuable as a clinician. In doing this research I have learned that I have an interest in data and I like to see real world outcomes and help obtain changes. I shifted my focus of my career therefore towards Healthcare Administration and have made it my goal to alleviate barriers to health that may exist whether financial, social, educational or simply just access.

Online Materials: <https://portfolio.com/entry/initial-implementation-in-school-based-setting>

Just Around the River Bend: The Problem with Water Privatization in Pakistan

Maria Shah '20 (Political Science & Human Rights, CLAS)

Advisors: Elizabeth Hanson, Professor Emerita, Political Science; Matthew Singer, Associate Professor, Political Science

Supported by: CLAS Alan R. Bennett Honors Fund

Project Summary

Water privatization is the transfer of the water sector from government management to the private ownership. It is often recommended and encouraged by the World Bank and other international financial institutions to developing countries as a way to improve their water resource and provide more quality water to people. However, privatization has also shown drawbacks. Through the use of four case studies - Chile, Brazil, Bangladesh, and India - I was able to assess what water privatization may look like in Pakistan. I argue that while privatization has been shown to improve water access and quality in a country, it often increases costs and is not sustainable in the long term. If privatization were to be implemented, it required government oversight to ensure the community needs are prioritized over large industrial and agricultural needs.

Reflection on Learning

The very first thing I have learned from this is that writing a thesis and completing an independent research project is not what I thought it would be. Despite this, it was a rewarding experience and one that I will cherish for some time to come. I began this project believing that my research would prove that privatization was completely bad because that was what I personally believed. However, after doing the research, I found that privatization does have the potential to improve a water system, if it is implemented with proper government oversight. I realized that there is a potential role and place for the private sector, which I completely disagreed with when I began the project.

I also learned a lot about things unrelated to the project, while engaging in this project. When I started college, I found it difficult to find support from my peers and from my professors. I began as a STEM major and was completely lost. When I changed majors, I lost support from my family and it seemed like no matter what I did - I got good grades, I joined the Honors Program, I began a thesis - it was not enough for my family. It was why completing this project at home became so difficult, as every day I was reminded by them that they wish I would just be a doctor.

However, I was lucky to find some support in the political science department through Professor Hanson, who stepped up to be my thesis advisor without knowing anything about me and only knowing that I needed an advisor, and Professor Singer who provided constant support and advice through the difficult process that was writing a thesis. I was definitely not the best student, I constantly submitted things late, became overwhelmed in the process, and felt like giving up multiple times in the year, however their support was the major reason I was able to pull through and eventually complete the project. It is something I will always be grateful for.

I was always told to not ask for help, and I have had experiences at UConn where asking for help put me in a worse off situation, however Professor Hanson and Professor Singer always had their doors open and always ensured that I could get help if I needed it.

Overall, I learned a lot about privatization and water management through this project, to the point that even my own worldview shifted. I also learned a lot about myself, and about the importance of finding people who support you if you want to succeed.

Using Machine Learning to Conduct a Detailed Behavioral Analysis in an Appetitive Social Learning Task

Thomas Shao '20 (Physiology and Neurobiology, CLAS), STEM Scholar

Advisor: Etan Markus, Professor, Psychological Sciences

Supported by: SURF Award

Project Summary

Learning by watching others, or observational learning, is important for social development and survival. However, not much is known about the brain mechanisms underlying this type of learning. Since the 1960s, observational learning has been studied in humans, but developing and analyzing experiments for animals has been challenging. Here, I explore observational learning using a novel paradigm while performing an analysis that involves tracking the rats using an active learning algorithm called Deep Lab Cut.

In this novel paradigm, customized operant conditioning chambers are used to give an observer rat multiple new observation trials, allowing for more power in the experiment. The task is automated which allows for more trials and creates less animal handling and bias.

For each trial the correct response changes in a random order. The demonstrator rat is shown the correct response (with a small light cue) and the observer rat must watch the demonstrator to know what to do. An analysis of this experiment uses Deep Lab Cut, an efficient method for tracking estimation allowing researchers to quantify behavior. Using videos gathered from the animals in the paradigm, detailed markers of the rats' ears and nose can be used to provide quantitative behaviors such as how well the rats are observing. I could quantitatively measure how directly the observer was watching the demonstrator rat, how often the observer was looking at the demonstrator, and how far apart the two animals were. The mean heading angle, percent time facing demonstrator, and mean distance give us those behaviors. Administering 3 different drugs, I was also able to determine differences in the tracking behavior on correct and error trials. On correct trials, the rats are looking more towards at each other, hence a higher heading angle, are facing the demonstrator more, and are closer together - all results I expected. What is not clear is if there is a drug effect, although more collection will be done in future studies.

Using Deep Lab Cut in an observational learning model is a novel method that provides much more power in these tasks. Developing this animal model to assess observational learning will lead to a better understanding of the neuronal circuits involved in social learning. The implications of combining machine learning to provide quantitative analyses in an otherwise behavioral approach is something that can be used in many future psychological studies.

Reflection on Learning

Throughout this project, I learned the importance of combining fields in analytical sciences as well as behavioral sciences. More importantly, I learned how to incorporate those fields together, as they can be seen as opposite ends of the spectrum, it is necessary that they are used to enhance one another. I wouldn't have a robust means of measuring observational learning if it were not for the use of machine learning. I will be using this knowledge in other future applications of research, thinking outside the box to see if machine learning can be used in other areas of scientific research. As in any research project, the ability to adapt to changes, persevere in challenges, and maintain a diligent working schedule is crucial and I feel that these skills have developed since the start of my SURF project to now working on my Honors thesis. Prior to the start of my project, my experience in research was more on the sidelines. It was certainly a learning experience collecting data, running experiments, etc but my experience last summer and this year allowed me to take a more active role on the frontlines. I was able to be a part in the design of the project as well as learn an entirely new software for animal position estimation - all developing my problem solving skills.

Online Materials: <https://portfolio.com/entry/using-machine-learning-in-a-social-learning-task>

Characterizing Nicotine Withdrawal Symptoms in Homeless Smokers

Gabrielle Sharbin '20 (Allied Health Sciences, CAHNR)

Advisor: Carla Rash, Assistant Professor, Medicine and Calhoun Cardiology Center

Supported by: Health Research Program, OUR Travel Award

Project Summary

In the US, homeless persons smoke at 5 times the rate of the general population (CDC, 2017, Public Health Law Center, 2016), and they experience difficulty quitting (Busnielle et. al., 2014). Nicotine withdrawal may be a barrier to initiating and sustaining successful smoking cessation. Nicotine withdrawal symptoms are well characterized in the general population; however, little is known about their severity and time course in homeless smokers. This secondary data analysis characterizes nicotine withdrawal symptoms, as measured by the Minnesota Nicotine Withdrawal Severity index (MNWS-R; Hughes & Hatsukami, 2005), in 70 homeless smokers in a randomized smoking cessation trial. MNWS symptoms were assessed at two time points prior to the scheduled quit date and twice weekly for 4 weeks post-quit date. All withdrawal symptoms were most strongly endorsed prior to the quit date and then declined post-quit date with substantial rates of endorsement even 4 weeks post-quit date (20% to 35%). Desire to smoke was the most heavily endorsed symptom (91%). Other symptom endorsement ranged 41% to 57%. Severity for most symptoms was at its lowest 2-3 weeks post-quit date, then increased weeks 3-4. However, increases in withdrawal symptoms 3-4 weeks after quit date may signal a time period particularly vulnerable to lapse or relapse. Regression analyses indicate that anticipatory withdrawal symptoms (measured pre-quit date) did not significantly predict the initiation of a quit attempt nor treatment outcomes over the 4 week treatment period. These findings suggest possible targets for intervention as part of smoking cessation counseling for homeless smokers.

Reflection on Learning

I have gained a lot of knowledge and experience by working on this project. I learned a lot about how smoking disproportionately affects homeless populations, and about the impact of nicotine withdrawal hinders smoking cessation. I also learned a lot of skills which I can bring to future research projects. For example, I learned how to conduct literature reviews, how to use SPSS, how to create a poster, and present it.

Online Materials: <https://portfolio.com/entry/nicotine-withdrawal-symptoms-in-homeless-smokers>

Expert Swimmers and Tank Potatoes: Swimming Behavior of Alewives (*Alosa pseudoharengus*) at Differing Migratory Stages

Erika Shook '20 (Animal Science, CAHNR)

Advisor: Eric Schultz, Professor, Ecology and Evolutionary Biology

Supported by: Sigma Xi Grant in Aid of Research, Walter Whitworth Fund and the John Rankin Scholarship Fund (Department of Ecology and Evolutionary Biology), Connecticut State Museum of Natural History Grant

Project Summary

Alewife (*Alosa pseudoharengus*) is a threatened and diadromous species, for which swimming performance is critical for survival into completing migrations between the marine and freshwater environments. While preliminary data shows that actively-migrating fish (migrants) have greater body size and swim-speeds than those not yet migrating (residents), it is unknown whether swimming behavior differs between these groups. To investigate this, I conducted a behavioral analysis on migrant and resident juvenile alewives. I hypothesized that migrants would have a greater frequency of long-term behaviors and active behaviors than residents.

Migrant and resident alewives were swum individually at one body-length per second in a swim tunnel and video recorded. Behaviors and time budgets were recorded using BORIS (1). State behaviors, exhibited for an extended period of time, and point behaviors, exhibited for one moment, were catalogued in an Ethogram and further categorized as "active," high energy, or "passive," low energy. T-tests were used to analyze group differences in behaviors. Migrant and resident juvenile Alewife show a significant difference in percent total duration of both active ($p = 0.0007$) and passive ($p = 0.0186$) swimming behaviors, but not in number of occurrences. Both groups were equally likely to exhibit the same behaviors, but migrants are able to exhibit those behaviors for a greater duration. This may be due to greater metabolic capacity.

My findings show that migrants are able to maintain behaviors for longer durations, which may increase migratory fitness and survival. Future studies should observe alewife behavior in a natural environment to better understand predator-prey behavior, an important component of behavioral ecology.

References:

1. Olivier Friard and Marco Gamba. (2016) BORIS: a free, versatile open-source event-logging software for video/audio coding and live observations. *Methods in Ecology and Evolution*, 7(11), 1324-1330

Reflection on Learning

Throughout my time conducting a behavioral analysis in the Schultz lab, I not only acquired valuable skills to carry with me into my future, but I also learned what it meant to be a part of a research community. Firstly, I was able to expand my knowledge of fish ecology, and refine my critical thinking and data analysis skills. Learning the basics of data collection and programming software like R will be very beneficial in any of my future positions in the marine science field. Prior to my time working in the Schultz lab, I had very limited experience conducting research, especially independently, so this project was foundational to my self-growth as a scientist. Additionally, the time I spent doing research was enhanced by an incredibly supportive and welcoming team in the Schultz lab. Partaking in this project has made me even more excited for new experiences and opportunities for growth.

Online Materials: <https://portfolio.com/entry/swimming-behavior-of-alewives-at-migratory-stages>

Contributions of *gyrA* and *parC* Mutations and *qnrS2* Acquisition to Ciprofloxacin Resistance in *Aeromonas veronii* Hm21

Daniel Silverstein '20 (Molecular and Cell Biology, CLAS), STEM Scholar

Advisor: Joerg Graf, Professor, Molecular and Cell Biology

Supported by: OUR Supply Award

Project Summary

Antibiotic resistance is a growing concern within the fields of medicine and microbiology. Since their introduction into healthcare, antibiotics have cured countless infections that would have proved fatal. Over time, bacteria have evolved to survive antibiotic treatments, increasing the spread of antibiotic resistant bacteria to new hosts. As a result, infections are becoming harder to treat. My project's goal is to characterize resistance to ciprofloxacin, a critical antibiotic to treat *Aeromonas veronii* (*A. veronii*), a known human blood pathogen. Ciprofloxacin, a fluoroquinolone, targets two DNA replication proteins, DNA gyrase and topoisomerase. Certain mutations in their genetic codes have been shown to cause resistance. There is also an accessory gene, *qnrS2*, that confers resistance by coding for an alternate target for ciprofloxacin. This gene is found on a plasmid that is transferred readily between cells.

The goal of my project was to observe how these factors contributed to resistance in a strain that is well characterized and susceptible to ciprofloxacin. I constructed mutants for DNA gyrase and topoisomerase, individually and in combination. Additionally, I tested two plasmids that carried *qnrS2* with different copy numbers but found that copy number had negligible effect on resistance.

I also found that with the combination of both mutations and the plasmid, *A. veronii* had intermediate resistance. To discover which additional mechanisms are responsible for providing resistance, I evolved the bacteria under antibiotic pressure. Multiple lineages developed additional resistance characteristics. I sequenced and identified candidate resistance alleles for future investigation which might become future antibiotic targets.

Reflection on Learning

Importantly, I have cultivated skills and experience, learning what I am capable of. Working in a lab has contributed to my confidence and comfort in new environments. When I started in the lab over three years ago, I felt overwhelmed by what I did not know. By the end of my undergraduate experience I was performing and designing experiments independently, as well as assisting and training other undergraduate and graduate students with their research projects, as an active contributing member of the lab. Additionally, I have been asked to continue working in the lab post-graduation, a testament to my dedication and contributions. I know I will use the critical thinking and scientific reasoning strategies I have developed in my future career path as a physician.

Efficacy of Depression Screening Tools in Young Adults with Symptoms of Autism

Aditi Sirsikar '22 (Physiology and Neurobiology, CLAS), Holster Scholar, STEM Scholar

Advisors: Inge-Marie Eigsti, Professor, Psychological Sciences; Vincent Moscardelli, Director, Office of National Scholarships and Fellowships

Supported by: UConn Co-op Legacy Fellowship - Change Grant

Project Summary

Autism spectrum disorder (ASD) is a neurodevelopmental condition that is characterized by challenges with communication and social interaction. A self-awareness of these social and communication limitations negatively affects a person's mental health and self-esteem. People with autism are therefore more susceptible to depression compared to the general population. Additionally, research suggests that depression in people with ASD is underdiagnosed due in part to challenges in recognizing mood disorders in this population. Alexithymia, a co-occurring condition characterized by difficulties in recognizing emotions, is common in people with ASD and may complicate the presentation of depression. The overlap of symptoms in depression and autism such as reduced appetite, social withdrawal, and sleep disturbances present added diagnostic challenges for providers especially for those who are not familiar with the presentation of autism in adults. Therefore the purpose of this study is to provide insight into whether depression screeners are effective for people with autism and to determine whether there is a need for autism-specific tools.

This study tests the efficacy of depression screeners in a non-clinical sample of individuals with low or high rates of autism traits. Analyses tested whether higher levels of ASD traits co-occurred with more symptoms of depression and also examined the convergence of self- and parent-reported depression symptoms in individuals with higher versus lower levels of autism traits.

Findings extend work documenting increased rates of depression in ASD in a non-clinical sample. Furthermore, self- and parent-reported symptoms of depression were less concordant for individuals who self-reported higher rates of ASD traits. That is, participants with more ASD traits perceived their own emotions and mental health differently than did their parents. This result is consistent with two possibilities: individuals with more ASD traits may have less insight into their own symptoms and therefore report symptoms differently; or parents may have less awareness of these symptoms in such individuals, because they are less sensitive to symptoms, because the individuals are less likely to verbalize their feelings, or because the experience of symptoms actually differs. These results do suggest a need for more examination of depression screeners for use in clinical ASD referrals.

Reflection on Learning

In regards to reflecting on self-growth through this process, I have become more comfortable with not knowing the answer to every question or the solution to every problem. I realized that obstacles are unavoidable and feeling lost is acceptable. Anxiety is not a productive emotion, and over this year I have come to embrace that through this project.

ETS-domain Transcriptional Activator Pnt and its Endogenous Inhibitor Yan Control Spatiotemporal Expression of Mmp2 for Follicle Rupture in Late Oogenesis

Ekaterina Skaritanov '20 (Physiology and Neurobiology, CLAS), University Scholar

Advisor: Jianjun Sun, Associate Professor, Physiology and Neurobiology

Supported by: UConn IDEA Grant

Project Summary

Spatiotemporal regulation of proteolytic enzyme expression and activation is critical for successful ovulation in both mammals and *Drosophila*; however, the molecular nature of this precise regulation is largely unknown. Our previous work has shown that Matrix metalloproteinase 2 (Mmp2) is upregulated in posterior follicle cells of stage-14 (mature) egg chambers in *Drosophila* ovaries. Mmp2 is essential for breaking down the posterior follicle wall to allow extrusion of the encapsulated oocyte into the oviduct, a process called follicle rupture. In this work, we found that the coordinated expression of ETS-domain transcription factor Pointed (Pnt) and its endogenous inhibitor Yan in late oogenesis is critical for precise regulation of Mmp2 expression in stage-14 posterior follicle cells. We demonstrate that Pnt is continuously expressed in posterior follicle cells from stage 10 to stage 14. Knocking down pnt in stage-14 follicle cells disrupts Mmp2 expression and follicle rupture, indicating that Pnt is required for Mmp2 upregulation. Consistent with this idea, ectopic expression of an active form of Yan, which inhibits Pnt transcriptional activity, in stage-14 follicle cells also prevents Mmp2 upregulation. We also find that Yan is enriched in the nuclei of all follicle cells from stage-12 to stage 13 and is downregulated in stage-14 follicle cells. All these data lead us to propose that the downregulation of Yan at stage 14 permits Pnt's role as a transcriptional activator to upregulate Mmp2 in posterior follicle cells. We characterize Mmp2 expression in the calyx of the oviduct and its role in ovulation by providing a compensatory mechanism for lack of Mmp2 in stage-14 posterior follicle cells. Altogether, our findings demonstrate a novel role for Pnt and Yan in regulating Mmp2 expression and ovulation in *Drosophila*, and such roles may be conserved in other animals.

Reflection on Learning

By completing this project I learned was able to decipher the role of downstream effectors of the Ras/MAPK pathway in ovulation in *Drosophila*. I learned the benefits of using *Drosophila* as a model organism and how it provides us with the opportunity to use powerful genetic tools in a fairly inexpensive way. Above all, however, I was able to hone my critical thinking skills and understand how basic science research is conducted. I'm sure that this skill will follow me for the rest of my career as a physician and scientist.

The Shape of Things to Come: Morphological Shifts in Juvenile Alewife Body Shape Preceding Emigration to Saltwater

Brandon Smith '21 (Ecology and Evolutionary Biology, CLAS)

Advisor: Eric Schultz, Professor, Ecology and Evolutionary Biology

Project Summary

Diminished population abundances of anadromous Alewives (*Alosa pseudoharengus*) compared to historical numbers has placed a need for the preservation and study of this ecologically important species. In particular, examination and characterization of physical traits that increase fitness and survivorship may have practical implications for effective population management. With recent evidence demonstrating that life history has a strong influence on body shape and size in Alewives, our goal was to identify within-population morphological characteristics at different stages of seaward migration for juvenile fish utilizing the Long Island Sound estuary. Juvenile developmental stages were split into two groups: fish that were out-migrating from their natal freshwater habitat into saltwater, and those still developing and residing in their natal waterbody. A total of 30 juvenile fish were collected from the Bride Lake (East Lyme, CT), consisting of 15 migrant fish from the outflow stream and 15 resident fish from the natal freshwater pond. We applied geometric morphometrics, utilizing principal components and canonical variate analysis to examine divergence in body shape between the two groups of individuals. Our results show a relatively small, but significant difference in body shape, in which migrant fish had a more fusiform body, smaller head, and slightly thinner caudal peduncle. Comparison of our observed trends in Alewife body shape to known expectations from the literature reveals a consistent pattern. These findings lead us to believe that selection pressures, such as life history, habitat availability, and predation, are responsible for the shift we see in juvenile body shape. We believe that the migratory life history and demand on swimming performance have induced selection for a body shape more conducive to efficient swimming and schooling in fish ready to move into the saltwater environment.

Reflection on Learning

From this project, I have learned first-hand the value of peer-review and hearing alternative perspectives. When working on a project for an extended period of time, you tend to overlook particular aspects that may be confusing to the average reader. It is both refreshing and essential to gather input from others, and I will continue to use this to my advantage moving forward.

Online Materials: <https://portfolio.com/entry/alewife-morphological-shifts>

Analysis of Mycotoxins and Pesticides in *Cannabis sativa* (Hemp) Utilizing Liquid Extraction and UPLC-MS/MS

Montserrat Sousa-Sanchez '21 (Biological Sciences, CLAS)

Patrick Ryan Relator '20 (Molecular and Cell Biology, CLAS)

Janet Wang '22 (Chemistry, CLAS)

Advisors: Anthony Provatas, Academic Assistant II, Center for Environmental Sciences and Engineering; James Stuart, Senior Research Scientist, Center for Environmental Sciences and Engineering, and Professor Emeritus, Chemistry; Christopher Perkins, Academic Assistant II, Center for Environmental Sciences and Engineering

Project Summary

The objective of this study is to analyze the mycotoxins and pesticides that may be present in samples of *Cannabis sativa* (hemp). Mycotoxins and pesticides can have detrimental effects on human health and therefore hemp must meet quality, safety, and efficacy standards in order to control such contaminants. There were five mycotoxins analyzed for: Aflatoxin G1, Aflatoxin G2, Aflatoxin B1, Aflatoxin B2, Ochratoxin A and five pesticides; Indole-3-butyric acid, Azadirachtin, Pyrethrin I, Pyrethrin II, and Piperonyl butoxide. The analysis was done by using Ultra-Performance Liquid Chromatography with mass spectrometry (UPLC-MS/MS). The detection limitations range from 0.4 ppb- 26.8ppb for mycotoxins and 0.6ppb-1875.0 ppb for pesticides. The method developed was rapid, efficient, sensitive, and selective for the analysis of the targeted contaminants in hemp. From the samples analyzed, there were no detectable traces of these contaminants present.

Reflection on Learning

Montse Sousa: Through this study I learned about the risks that pesticides and mycotoxins can have if they are present in crops. It is important for growers to know what is in their products because for some of the contaminants, such as mycotoxins, a slightest bit present could severely harm a person that consumes or is exposed to the contaminant. This study also taught me that the range of detection limits is so wide for the different contaminants that it can be hard to compare them and our inability to detect any of them from the samples is not an absolute that they are not at all present.

Patrick Relator: While working on this project, I learned a lot about the importance of detecting mycotoxins and pesticides in the hemp samples. This was my second semester working in the CESE Organics Laboratory and I was able to work on my practical skills in a lab setting. This research product taught me both how to work in a group for projects with many samples, as well as the methods used to analyze the hemp samples. This project also helped me understand the chemistry behind analyzing these samples and being able to relay the information that I learned to other students who were new to the lab. Overall, it was exciting to be in one of a handful of labs that are able to work with hemp samples in Connecticut.

Janet Wang: This study reinforces the importance of knowing the contents in any given product. With regards to *Cannabis sativa*, whether we use textiles composed of the crop's fibers, consume medicine that utilizes the plant's health benefits, or use the plant in another manner, it is crucial that we have examined the possible risk factors present. While this study tests specifically for the mycotoxins and pesticides allowed in the state of Connecticut, we must not forget that other states and countries hold different guidelines as to what contaminants can or cannot be present in their products. Variations in standards exist not only for *Cannabis sativa*, but for other products as well. As a result, this study reminds me that I, as a consumer, must be mindful of product origin, contents, and risks.

Online Materials: <https://portfolio.com/entry/analysis-of-mycotoxins-and-pesticides-in-cannabis>

A Change of Heart? Shifts in Juvenile Alewife Heart Size and Lipid Content Prior to Migration

Jacqueline Stephens '20 (Biological Sciences & Mathematics, CLAS)

Advisor: Eric Schultz, Professor, Ecology and Evolutionary Biology

Supported by: Sigma Xi Grant in Aid of Research, Walter Whitworth Fund and the John Rankin Scholarship Fund (Department of Ecology and Evolutionary Biology), Connecticut State Museum of Natural History Grant

Project Summary

The process of migrating to a new location requires a large amount of energetic input. This especially rings true for diadromous species, whose lives consist of cycling between freshwater and seawater environments. Some diadromous species show distinct morphological changes in preparation for migration; a key example being juvenile Atlantic Salmon (*Salmo salar*) parr marks transitioning into silver scales before heading to sea. However, obvious external changes are not present in all diadromous fishes. Alewife (*Alosa pseudoharengus*) is one such species for which juveniles only show subtle changes in body size and shape prior to migration. The purpose of this study was to look beneath the surface to find internal changes occurring in preparation for migration. Two physical attributes and one performance assessment of migrant (actively-migrating) and resident (pre-migration) alewives were investigated: lipid content, ventricle mass, and swimming speed. I hypothesized that (1) migrants will have a larger lipid content for increased energy storage, (2) ventricles of migrants will have greater mass than those of residents for higher cardiac function, and following suit with the prior (3) larger hearts and increased energy storage will lead to better whole-body performance (i.e., swimming speed). Fish were collected in summer 2019 from the natal freshwater environment, exposed to seawater for 24 hrs, measured for swimming performance, and dissected for organ and tissue composition analysis. Hearts were excised and weighed pre- and post-drying, and a soxhlet extractor was used for lipid analyses. The results of this study will contribute to our knowledge of migratory ecology by increasing our understanding of key shifts in juvenile Alewife morphology and performance. This is important to the efficacy of conservation and management efforts for Alewife, a species that has experienced drastic population decline since the 1960s and is currently listed as a Species of Concern.

Reflection on Learning

I believe that I became a better scientist through the engagement in my research project. On top of gaining tactical skills in the laboratory by getting familiar running tissue composition extractions and conducting dissections, I improved my creativity towards questioning and supporting topics of interest. Simple answers are usually never given, so being able to brainstorm new explanations or possible interactions is important for a future in science.

Further Exploration of Mouse Corneal Schwann Cells

Connor Treadwell '22 (Physiology and Neurobiology, CLAS)

Advisors: Paola Bargagna-Mohan, Assistant Professor, Neuroscience; Royce Mohan, Professor, Neuroscience

Supported by: Health Research Program

Project Summary

My project, under Dr. Paola Bargagna-Mohan at UConn Health, was an introductory project to study corneal Schwann cells in mouse corneas. Giving more background, the cornea is the transparent, protective, outer layer of the eye, and is the most densely innervated tissue in the human body. Corneal injury causes opacity and severs corneal axons, resulting in potential blindness, loss of sensation, and corneal pain. This is of clinical importance, as it results in corneal fibrosis and scarring, which is the 4th leading cause of blindness worldwide. Schwann cells are specialized glial cells devoted to protect and maintain the health of corneal axons. Corneal axons have been studied and characterized upon injury, as has the role of the stromal cells. However, little is known about the role of corneal Schwann cells (cSCs) in the process of corneal repair. Our lab discovered that cSCs have plasticity and contribute the injury repair in a transgenic mouse model. Now, we propose to map, for the first time, the entire network of Schwann cells in a wild type mouse cornea. Regarding the methods, I used whole mount: mice were sacrificed, and corneas were collected (n= 5 mice). Epithelium and endothelium were scraped out and samples were prepared for immunohistochemistry (IHC). I also used immunohistochemistry (IHC): samples were fixed with 4% paraformaldehyde (PFA), then blocked/permeabilized for 48h with 0.5% Triton X, 1% bovine serum albumin (BSA), and 5% goat serum. Samples were stained with anti-rat L1 antibody (1:200) and secondary antibody anti-rat Alexa 555. Nuclei were stained with DAPI. Images were captured at 60X using an Olympus IX81 microscope. Lastly, images were assembled on Adobe Photoshop and a complete map was manually created. The number of nuclei associated with each Schwann cell ramification was counted with the assistance of ImageJ cell counting software. After initial estimates were made for associated nuclei for each Schwann cell, a graph was created. For the first time, we mapped the cSCs in a whole mount preparation in a wild type mouse. Also, cSCs appeared to be more densely populated at the periphery compared to the central area. Next, based on these initial findings, the average number of cSCs ensheathing a "complete branch" is around 74 cells. This analysis is of clinical importance especially after injury and in a repair paradigm.

Reflection on Learning

Through the opportunity of working with Dr. Paola Bargagna-Mohan in her lab, I have gained a number of useful lab skills, including immunohistochemistry, whole mount, microscope use, and photoshop use. I have also gained a greater understanding of the cornea anatomy, the eye, and how to think critically.

Characterizing the Virome of Two Species of Wild Migratory Birds

Inglis Tucker '20 (Molecular and Cell Biology, CLAS)

Advisor: Sarah Hird, Assistant Professor, Molecular and Cell Biology

Supported by: SURF Award

Project Summary

The objectives of this study were to 1) characterize the blood and fecal viromes of two key long-distance migratory shorebirds – the red knot (*Calidris canutus*) and the ruddy turnstone (*Arenaria interpres*), and 2) identify how body condition correlates to the shorebird virome during spring migration staging in Delaware Bay. This project was the first in-depth study of viromes of long-distance migratory birds. The results can be used to enhance etiologic understanding of outbreaks of disease and identify novel viruses that have yet to be studied. These findings shed light on how viruses interact with migratory hosts, their immune systems and microbiomes, and through publication of the results, lead to further research into the immune function and viral ecology of migratory bird species.

Reflection on Learning

This project was exciting to work on and I learned a vast amount in the process of working on it. The work is still ongoing and will continue into its future stages when and if conditions allow. The biggest takeaway I have from this project is how important the people are who are so willing to lend their knowledge and expertise to undergraduate projects here at UConn, especially Bo Reese at CGI, Professor Simon White and Professor Dong Hun Lee as well as everyone in the Hird lab. Without their in depth knowledge and willingness to teach, research like this would not be possible.

Applications of Data Science to Writing Center Research

Eli Udler '20 (Computer Science and Engineering, ENG; English, CLAS)

Advisor: Tom Deans, Professor, English

Supported by: OUR Travel Award

Project Summary

The UConn Writing Center has generated a large amount of text data throughout 10 years of operation. This data can be the source of actionable insight into writing center practices, telling us what kinds of concerns students come in for and what they spend the most time working on. With this study, we attempt to put data behind many of the patterns we observe at the center.

The natural language data set on which we test our methods consists of ten years of intake forms, which are written by students, and the corresponding post-tutorial session summaries, which are written by peer tutors (there are approximately 40,000 of each). The intake forms are brief, typically 2-40 word, responses to the question "What do you want to work on? (Details please!)" and keyed in by students when they make a writing center appointment. The session summaries/tutor notes are typically 80-150 words of summary/quick reflection/revision plan, written by the tutors immediately after each session with the student writer in mind as the audience (student writers can also elect to have the tutor note emailed to their instructor).

This study applies a quantitative analysis to this qualitative data with the goal of arriving at actionable insights. We use text analysis tools such as Natural Language Toolkit for Python and employ a number of methods, including word frequency analysis, n-gram analysis and sentiment analysis.

We looked for common n-grams in the data set and compiled a list of seven categories, each corresponding to a kind of concern. These included sentence-level editing, structure, thesis statement, citation and evidence. We then constructed graphs comparing the frequency of occurrences of words in each category in the intake form and in the tutor note.

Reflection on Learning

The most important piece of insight was the large discrepancy between sentence-level concerns in the intake form and in the tutor notes. We suspect that there are a number of reasons for this. Students may not have the vocabulary to specify exactly what they want from the session and may simply ask to work on grammar. Additionally, tutors may find concerns that are more pressing than grammar, such as the strength of an argument in a persuasive essay, and direct the student to work on those first. This emphasis on "higher-order concerns" can be useful for some students, but may alienate others, including ESL students. This study lends support to the newly-implemented grammar hour, which offers tutorials with an emphasis on such sentence-level issues.

The Effects of Maternal Nutrient Restriction and Realimentation on Lipid Accumulation in Offspring Muscle Tissue

Hannah van Bergen '20 (Animal Science, CAHNR)

Advisors: Kristen Govoni, Associate Professor, Animal Science; Sarah Reed, Associate Professor, Animal Science

Supported by: OUR Supply Award

Project Summary

Poor maternal nutrition is known to have negative repercussions on offspring metabolism during fetal development through fetal programming, leading to increased fat synthesis and storage. Nutrient restriction has been shown to reduce lipid accumulation in offspring muscle at 3 months of age. Lipid accumulation, or intramuscular fat (IMF), is a significant aspect of both metabolism and meat quality, and is impacted by realimentation. Realimentation is a management practice in which animals are fed 100% of dietary needs or an excess of their typical caloric intake following a period of restricted nutrition. We hypothesized that maternal nutrient restriction followed by realimentation will alleviate the effects of poor maternal nutrition on offspring muscle lipid content.

To test this, forty-eight ewes pregnant with singletons were fed a control diet of 100% National Research Council (NRC) requirements beginning at day 25 of gestation. On day 50, seven ewes were randomly euthanized and the rest assigned to a diet of 100% NRC (CON) or 60% NRC (RES). On day 90, seven ewes were euthanized and fetal semitendinosus samples were collected. The remaining ewes stayed on their diet (CON-CON and RES-RES) or were switched to the opposing diet (CON-RES and RES-CON). On day 130, all ewes were euthanized and fetal semitendinosus samples were collected. Day 130 fetal semitendinosus samples were sectioned using a cryostat and stained using an intramuscular lipid protocol. Sections were visualized using an Axiovert Wide-Field microscope and quantified using Image J. Statistical analysis of area LSMEAN was completed using the Least Squares Mean function in SAS. $P \leq 0.05$ was considered significant. CON-CON lambs had 34.8% less lipid accumulation than CON-RES ($P=0.0174$), 42.7% less than RES-CON ($P=0.0024$) and 36.2% less than RES-RES ($P=0.0131$). Therefore, it was determined that a restricted or realimented diet increased lipid accumulation in the muscle tissue of day 130 offspring. This is significant as it demonstrates that realimentation does not alleviate the effects of poor maternal nutrition on offspring lipid content.

Reflection on Learning

By participating in this project, I gained a better understanding of advanced scientific research, learning how the research process develops from being an idea to a fully performed project with significant results. This research project and my laboratory work in general advanced my research-specific skills and improved my ability to analyze and understand scientific papers. Through conducting research and analyzing previous research done by the lab I was in, I broadened my knowledge of scientific terminology and gained a better understanding of issues in the animal science industry that researchers are interested in. With my specific project I developed skills in collaboration through my need to utilize multiple professors and graduate students whose laboratory experience greatly benefited in the process of obtaining and analyzing data. Due to my experience on this project I was able to see that the success of individual laboratory projects relies on the collaboration and forward thinking of all persons involved, and am very thankful for all who assisted me in my effort to complete the project.

A Consistent Classical Relativistic Model of a Finite Size Particle

Mira Varma '20 (Physics, CLAS), STEM Scholar

Advisor: Peter Schweitzer, Associate Professor, Physics

Project Summary

The understanding of the internal structure of the proton, neutron and atomic nuclei is at the forefront of current research in modern nuclear physics. The goal of my project is to explore a consistent classical model for the description of the proton structure to study quantities related to the energy-momentum tensor. The energy-momentum tensor contains information about the most fundamental properties of a particle, such as the well-known mass, but also the property known as the D-term. The D-term is a term used in theoretical physics to describe the last term of a superfield (a field that depends on all coordinates of superspace). In this project, I computed the energy-momentum tensor of the classical model and obtained the pressure and shear force. The pressure qualitatively agreed with recent experimental findings presented in *Nature* in 2018. Further studies should be done to investigate the effects of the long-range forces on the stability of particles and the D-term.

Reflection on Learning

This project taught me a lot of math that was not on the undergraduate curriculum as well as how to persevere when given a difficult task. To complete this thesis, I had to read a graduate Electricity and Magnetism textbook (Jackson) in order to learn about tensor analysis. This knowledge is especially helpful because I plan on getting a PhD in physics. When I get my PhD, I will have to know this mathematics and also when I write my PhD dissertation I will have to know how to persevere when facing a seemingly impossible task. This research is important because it shows that a classical model can be used to understand a particle (in this thesis, the particle's parameters were that of a proton). Usually all models of particles are quantum mechanical in nature, so this model is a unique way to understand basic characteristics of a particle. Additionally, doing this research raised the question of why the D-term couldn't be calculated, which other scientists can branch upon and explore. In addition, writing up my thesis was the first time that I had used Latex, and I learned about how to write a scientific paper, which I had never done before.

Physiological Characteristics of UC1MT, An Anti-Metallothionein Monoclonal Antibody

Jasmine Vazquez '20 (Molecular and Cell Biology & Urban and Community Studies, CLAS)

Advisors: Michael Lynes, Professor, Molecular and Cell Biology; Clare Melchiorre, Research Assistant III, Molecular and Cell Biology

Project Summary

Metallothioneins (MTs) are a family of cystine-rich proteins that are released in response to stress. MT plays a role in metal homeostasis by moderating the effects of toxic heavy metals such as mercury and cadmium. MT also plays a role in free radical scavenging and protecting against reactive oxidative species. Despite the lack of a signal peptide sequence, evidence has suggested MT is also present in the extracellular domain. MT can influence disease progression in inflammatory diseases including type 1 diabetes (T1D) and inflammatory bowel disease (IBD). Overexpression of MT in T1D and IBD can be regulated by UC1MT, a monoclonal antibody to MT. In T1D and IBD, the use of UC1MT as a therapeutic resulted in decreased blood glucose levels and inflammation, respectively. Mice co-immunized with MT and ovalbumin (OVA) showed a decrease in anti-ovalbumin production compared to mice co-immunized with just OVA. Injection of UC1MT reversed this immunosuppression. This project aims to further characterize properties of UC1MT and synthetic transgenic derivatives of UC1MT, including the specificity to MT, stability, and effects on cytokine production. ELISA, a plate-based assay, was used to accomplish these characterizations. First, I analyzed cross activity between UC1MT and metalloproteins which included alcohol dehydrogenase, carbonic anhydrase, superoxide dismutase, cytochrome c oxide, human insulin, and MT. Amongst the tested metalloproteins, MT had the highest affinity to both mouse recombinant and humanized UC1MT. I then tested the stability of two mouse recombinant UC1MTs that had been left on the bench for 7, 5, 1, and 0 days. MT showed to bind at a higher rate to UC1MT the longer the sample had been left on the bench. This could be due to UC1MT aggregating while sitting on the bench, causing an increased signal. Finally, I examined the effect of co-injection of UC1MT on cytokine production of IL-6, TNF- α , and IL-1 β . Groups of mice were injected with variations of OVA, to stimulate the immune response, aluminum, to mount a stronger inflammatory response, UC1MT and other controls. Lavage samples were taken from the peritoneal cavity of each group and tested for the presence of cytokines. Results showed an overall low presence of cytokines, regardless of group, which is likely due to diluted samples. Future directions include acquiring affinity constants of UC1MT and MT by SPR and testing cross activity of other metalloproteins in the inflammatory pathway.

Reflection on Learning

Embarking on this research project has helped me build my critical thinking and written communication skills. I have learned techniques such as ELISA and OpenSPR, and have gained a deeper understanding of immunology.

Online Materials: <https://portfolio.com/entry/uc1mt-an-anti-metallothionein-monoclonal-antibody>

The *Enterobacter hormaechei* 3,4-dihydroxyphenylacetate 2,3-dioxygenase and Transcription Factor TyrR Affect its Induction of Melanization in *Cryptococcus neoformans*

Ally Watson '20 (Molecular and Cell Biology, CLAS)

Amy Nelson '20 (Molecular and Cell Biology, CLAS)

Advisor: Joerg Graf, Professor, Molecular and Cell Biology

Project Summary

Cryptococcus neoformans is a yeast present in the microbiota of mammalian, avian, and arboreal hosts [1]. This opportunistic pathogen is capable of producing melanin, which functions to protect against UV light and promotes virulence by weakening host immune system [2]. However, *C. neoformans* melanogenesis is unique due to its requirement for exogenous substrates and can be induced by homogentisic acid, catecholamines, or their precursors L-tyrosine and L-DOPA. Prior research indicates that bacteria in the environment may be the source of these exogenous substrates [3]. Our research focuses on studying the role of *Enterobacter hormaechei*, a mosquito gut isolate, in melanogenesis of *C. neoformans* with respect to the production of L-DOPA, homogentisic acid, or other metabolites by this bacterium. 7,008 *E. hormaechei* transposon mutants were screened for their ability to induce melanogenesis in *C. neoformans* when grown together via melanization assays. 47 *E. hormaechei* mutants that induced altered melanogenesis phenotypes were isolated and their genomes were sequenced to identify the genes disrupted via transposon mutagenesis. Two genes were selected for further investigation encoding TyrR, a transcription factor known to regulate genes involved in amino acid metabolism and L-DOPA synthesis, and 3,4-dihydroxyphenylacetate 2,3-dioxygenase, an enzyme involved in tyrosine metabolism and homogentisic acid synthesis. Both of these genes will be characterized in *E. hormaechei* for their role in inducing *C. neoformans* melanogenesis through gene complementation, melanization assays, mass spectrometry, and melanin particle analysis.

1. Frases, S., Salazar, A., Dadachova, E., & Casadevall, A. (2007). *Cryptococcus neoformans* Can Utilize the Bacterial Melanin Precursor Homogentisic Acid for Fungal Melanogenesis. *Applied and Environmental Microbiology*, 73(2), 615-621.
2. Casadevall, A., Rosas A. L., & Nosanchuk, J. D. (2000). Melanin and Virulence in *Cryptococcus neoformans*. *Current Opinion in Microbiology*, 3, 354-358.
3. Frases, S., Chaskes, S., Dadachova, E., Casadevall, A. (2006). Induction by *Klebsiella aerogenes* of a Melanin-Like Pigment in *Cryptococcus neoformans*. *Applied and Environmental Microbiology*, 72(2), 1542-1550.

Reflection on Learning

Amy Nelson: After working on this project for the extent of my junior and senior years at UConn, I can soundly say that I've experienced both the excitement and frustration that comes with research. Aside from learning techniques in the laboratory, I have improved my presentation and collaboration skills as well. I gained experience collaborating with individuals in my own lab, working very closely with my peer Ally Watson, and also individuals at other universities. Sometimes, there can be a lag in communication between labs so rather than waiting for a reply, I learned to try to resolve my own questions through trial and error experimentation. Together, Ally and I used this method to determine the correct medium to perform melanization assays, the ideal growth conditions for our bacterial and fungal strains, and the best set-up for streaking the bacterial and fungal stains for our assays. Another key skill I learned on this project was planning ahead. Performing melanization assays required preparation steps 48 hours and 24 hours prior to the actual assay, then additional steps 24 hours and 72 hours after the assay. If earlier steps weren't completed, subsequent steps would be pushed back or sometimes there'd be no other choice but to restart the 6-day process. To avoid this inconvenience, I learned to think ahead meticulously.

Working closely with another undergraduate allowed me to learn how to divide and conquer tasks efficiently, clearly communicate what has been accomplished and what still needs to be done, patiently explain details of a technique and actively listen to someone who is explaining points to me. Finally, I learned the importance of double checking your work even if there are multiple people thinking things through. It's easy to just agree with someone; however, taking the time to question your peer and heed inquisition on their part often benefits both of you in the end.

Professionally, my experience with this project helped me obtain a research internship at Albert Einstein College of Medicine last summer and further a job in the same lab following graduation. More importantly, I feel confident in my ability to work in new labs in graduate school and beyond where I'll have to work with others, learn from them, and also teach others. I'm incredibly thankful for the opportunity to work in Graf lab as an undergraduate, mentored by Dr. Jeremiah Marden, because it's helped me plan my future and discover my specific interests within biology.

Ally Watson: Working on this project for nearly two years, I have gained many laboratory skills that I have been able to apply in other lab settings outside of UConn or to my own studies. But beyond that, I feel that I have grown more holistically as a student and individual gaining independence, critical thinking, and interpersonal skills that will carry me through each chapter of my life.

Working on this project, we spent a lot of time troubleshooting and jumping many hurdles to optimize our media and technique for the melanization assays that are at the core of the project. I learned how to deal with miscommunication and how to remain optimistic when experiments failed. I learned that failures aren't necessarily setbacks, but opportunities to think outside of the box to determine new solutions or formulate new techniques to prevent that failure in the future. Gaining these skills early on in our project helped us remain patient as we tested over 7,000 mutants, and resilient even as research was halted due to the current COVID-19 pandemic.

Working in a lab, particularly a microbiology lab, where it is necessary to meticulously plan a schedule for cultures and growth periods to ensure the viability of your cells, time management was one of the most important skills to gain. As an undergraduate it can become difficult to devote enough time to classwork, extracurricular activities, jobs, and other obligations. Working in a lab initially made this even more challenging as my experiments required much of my time and attention. However, I found that this initial challenge grew much easier over my three and a half years in the Graf Lab allowing me to become proficient in time management. I learned how to effectively plan my experiments ahead of time to ensure their success, while simultaneously planning for all other obligations.

However, I think what stands out the most to me and will have the greatest impact on me overall is the teamwork required to get this project done. I have worked individually in the Graf Lab and I have worked in partnership. Working on this project as a team with Amy Nelson made all the difference. I still was able to gain my independence and confidence in the lab but I had another brain to constantly bounce ideas off of or consult when I was stuck on an idea. I learned how to compromise, effectively explain my own thoughts, and actively engage in hers. Having multiple people work on one project increased our efficiency because we were able to combine our own insights or individual skills to better each other and the project overall.

As I move onto the next chapter of my life entering Hackensack Meridian School of Medicine at Seton Hall, I will carry each of these skills with me. Problem solving and time management will increase my efficiency and effectiveness as a health care provider. However, working in the healthcare field, where teamwork is at the forefront, my experiences in partnership throughout this project will allow me to work confidently and successfully with my future classmates and colleagues. I am so grateful to Dr. Graf for allowing me this incredible opportunity my freshman year and for Dr. Marden whose continued guidance and support allowed Amy and me to grow and develop in the lab. Learning these lessons and having these experiences will aid me not only in my future research, but in all future endeavors.

Neuroimaging Studies of Reading Intervention: A Meta-Analysis

Emma Wolfman '20 (Psychological Sciences, CLAS)

Advisor: Nicole Landi, Associate Professor, Psychological Sciences

Project Summary

Children with reading disability (RD or developmental dyslexia) are characterized as having difficulty learning to read, despite having otherwise normal intelligence and access to reading instruction. Various types of reading intervention have been shown to yield effective behavioral outcomes, but the neural mechanisms underlying intervention responses are not well understood. One meta-analysis of functional MRI (fMRI) studies of reading intervention (Barquero et al., 2014) provided an important initial overview of brain regions that show activation changes in response to intervention. However, this analysis is limited in scope and does not account for responsiveness to intervention. Additionally, Barquero and colleagues did not account for many factors that vary across reading intervention studies such as intervention style, intensity, and duration that may impact results. It is our goal to conduct a more current meta analysis testing for differences in patterns of brain activation in children with/at risk for RD following intervention. Studies with participants with or at risk of RD that used fMRI to examine brain activation during reading-related tasks pre- and post-reading intervention were selected for the meta-analysis. Our search yielded 34 studies meeting criteria for inclusion in the systematic review, and the number of studies to be included in the meta analysis is to be determined. Analyses are currently in progress, and the results will help to distinguish patterns of normalization vs. compensation in brain activation, identify changes in activation linked to successful response to reading intervention, and discover whether certain aspects of intervention implementation are related to changes in brain activation. Compiling data and analyzing the results across multiple studies provides greater implications for tailoring styles or dosages of interventions to children based on their individual sets of reading deficits.

Reflection on Learning

For the past three years or so, I have been working in Dr. Nicole Landi's lab that seeks to better understand the neural mechanisms of typical and atypical reading and language development. I've had the opportunity to work on various tasks including pediatric MRI editing using specialized computer software, poster construction for academic presentations, and most recently, a meta-analysis of neuroimaging studies of reading intervention. This line of research is important to me because I think reading is something that many of us take for granted. Before joining the lab, I never really thought about the profound impacts reading disabilities like dyslexia could have on the lives of children. Having the opportunity to work on projects and learn about the complexity of the neural basis of reading disorders has been a great way to spend time as an undergrad interested in medicine. My work in the Landi Lab has allowed me to explore research pertaining to the neurobiology of language, and has bolstered my confidence in navigating and reading academic research papers of any kind. The meta-analysis presented at this virtual conference has been of particular interest to me, because I got to learn about the importance of collaborative science. Performing analyses across many studies with similar goals allows for stronger results that may have great implications for helping improve quality of life.

Focused Ultrasound Stimulation for Spinal Cord Injury

Eric Woon '20 (Physiology and Neurobiology, CLAS)

Advisor: Martin Han, Associate Professor, Biomedical Engineering

Project Summary

Spinal cord injury (SCI) can result in loss of autonomic and motor functions. Our study aims to alleviate the loss of bladder control due to SCI, through the use of implanted micro-focused ultrasound stimulator (μ FUS). We know that the sacral spinal cord plays a vital role in the control of the bladder and external urethral sphincter (EUS). Within the spinal cord there is the sacral parasympathetic nucleus (SPN) with the preganglionic neurons necessary for bladder contraction, and the Onuf's nucleus (ON) which contains the EUS motor neurons. The Dorsal gray commissure (DGC) nuclei contain interneurons that innervate both the SPN and ON. Created with our collaborations, the μ FUS is implanted in the sacral spinal cord (S1-S2) via a dorsal laminectomy and accessed through a skull pedestal. This allows us a minimally invasive means of highly localized in vivo stimulation. Bladder function is evaluated through the stimulation of the μ FUS and the recorded through cytometric urodynamic measures. The first set of aseptic surgeries were performed on bladder catheterized rats, with one successful recovery. A prototype of the μ FUS was implanted on the lumbar sacral spinal cord with a cable tunneled to the skull. More chronic aseptic surgeries will be conducted throughout the summer with further urodynamic analyses. With these chronic studies we can evaluate the optimal range for ultrasonic stimulation to the spinal cord to trigger the maturation reflex, providing us with an easily customizable device.

Reflection on Learning

This project has taught me a lot about problem solving. With a project that has many moving pieces, there is a lot that can go wrong. Working and operating on animal subjects provide an extra set of challenges. Throughout the project minor adjustments were always needed in order to continue progressive research and maintaining the animal's well-being. As a physiology and neurobiology major, I have learned a great deal working with biomedical engineers. This project has allowed me to grow to approach problems with a different perspective and create productive solutions.

Spanish Translation and Back-Translation of Self-Management Modules for Breastfeeding Pain

Crystal Yumbla '22 (Psychological Sciences, CLAS)

Juan Torvisco '20 (Allied Health Sciences, CAHNR)

Advisor: Ruth Lucas, Assistant Professor, Nursing

Supported by: Work-Study Research Assistant Program (C. Yumbla)

Project Summary

The purpose of this project was to help address pain while breastfeeding on the breast and nipple. Many women may receive pain medications for a variety of reasons, but for breastfeeding, non-pharmaceutical methods are best for both the mother and the newborn. Providing modules for mothers in both English and Spanish help to address these issues at a larger scale. Translating these powerpoints into Spanish allowed us to access a more vulnerable population, which is the non-speaking English mothers, who speak Spanish. Lively and “nurturing” videos were our goal to capture the attention of the viewer while listening to these modules as well.

Wording the modules in a simple understanding level was also implemented in order for mothers with different levels of education to be able to understand these methods. Providing this knowledge to mothers experiencing pain due to breastfeeding can help reduce pain with accessible methods. Breastfeeding pain may be under addressed on a one-to-one basis. We have made them on specific topics: Breathing Therapy, Guided Imagery, Mindfulness, Non-pharmacological Therapies, Breastfeeding Problem Solving, Problem Solving (General Pain), and Pain Associated with Breastfeeding overall. These modules could be used in several clinical hospital settings for mothers who experience nipple and breast pain while breastfeeding. Women who experience these types of pain can be recommended these modules in order to teach themselves alternative methods for alleviation.

The accessibility of the language used in the powerpoints also allows these methods to cross barriers and allow for greater use in surrounding communities. This project can help in clinical breastfeeding studies that can be executed in the future and be used as alternative methods for treating minor symptoms of nipple and breast pain due to breastfeeding. This topic is interesting because it can be a neglected problem among new mothers and even mothers who are having another newborn and have not yet been able to address their breastfeeding pains.

Reflection on Learning

Juan Torvisco: As an aspiring nurse student I learned many significant steps that mothers can take to reduce breast and nipple pain while breastfeeding. Providing this information to mothers in both English and Spanish will help address issues that most mothers are affected by after their pregnancy. These modules were created to help mothers to learn better methods of healing other than pharmaceuticals as long as their doctors are aware of it. These potential practices can have a significant positive effect on the mother and baby in increasing bonding time, lactating rate and correcting breastfeeding position. Furthermore, we decided to translate the originally created English powerpoint into Spanish to reach non-english speaking mothers who speak Spanish. This type of inclusivity has been done in different aspects of the medical field, which should also be encouraged in research.

Crystal Yumbla: When beginning this project I was very excited for the topic and the help we would be providing to women in the community. I am naturally interested in Women's Health and the field of OB/GYN. I learned a lot from the material of this project and the implementation of such information. Prior to beginning this, I was unaware of this issue in the medical field and I since then I have been able to learn how to help address this pain issue in breastfeeding mothers. Being able to use my bilingualism in order to help others has also been amazing by letting me help those who may not know English fluently within our society. I have learned a lot of the different aspects involved with pain as well and the women who have not been provided this information.

Online Materials: <https://portfolio.com/entry/modules-for-breastfeeding-pain>

Effects of a Clinical Pharmacy Program on Influenza Vaccination Rates in Pregnancy

Ming Zhang '22 (Pharmacy Studies, PHR), STEM Scholar

Yifeng Wang '22 (Pharmacy Studies, PHR), STEM Scholar

Mai Vestergaard '23 (Pharmacy Studies, PHR; Music, SFA)

Advisor: William Baker, Associate Professor, Pharmacy Practice

Project Summary

As a part of a national ACCP (American College of Clinical Pharmacy) Research Challenge, our objective was to design a research proposal to demonstrate the value of clinical pharmacy in women's health. Almost half of all pregnant women do not get the influenza vaccine, despite its demonstrated benefits. Pharmacist involvement has been shown to increase vaccination rates in multiple populations. However, few studies explore the effect of pharmacy interventions on influenza vaccination rates in pregnant women. Our proposed research will address this knowledge gap by implementing a pharmacy-driven vaccine program utilizing pharmacists as both educators and administrators.

The specific aim of our study is to determine the effect of this intervention on pregnant women at an outpatient clinic. We will achieve this through a randomized controlled trial, comparing outcomes between a control group receiving standard care and an intervention group enrolled in the pharmacy intervention program. Our hypothesis is that the program will increase influenza vaccination rates, correct patient misperceptions, and decrease influenza-related healthcare visits.

Because this is a hypothetical study, we will not be implementing and collecting data ourselves. However, if we are in the top 3 teams of the competition, we will present our proposal at a national conference, where practicing clinical pharmacists can be exposed to/inspired by our study design to implement similar measures at their practice sites. This could lead to valuable data that helps fill the current gap in research, which is an ongoing clinical problem.

Reflection on Learning

Ming May Zhang: While this study is hypothetical, the challenges and settings it introduced are very real. In an increasingly interprofessional healthcare world, pharmacists are often asked to demonstrate their clinical value, and many pharmacists take the lead on visualizing and implementing various initiatives. I learned from this experience how to conceptualize and articulate a study that is both relevant and realistic. Similar to what happens in an actual practice setting, we were limited to a narrow budget and a specific research area of interest. I gained several key skills from this, including assessing and mining the literature, writing NIH-formatted grants, and integrating reviewer feedback. I am confident that these skills will make me a stronger clinical pharmacist.

Ethan Yifeng Wang: I learned how to perform power calculations to give us the sample size our study needed and how to randomize patients in a randomized controlled trial, as well as specific NIH-grant writing language (rationale, specific aims, long-term goals, etc.) along with May and Mai. This will help me with my future prospects, as I could transition into academia/research further along in my career. Something that I was surprised to learn was how great research ideas could come from observations in the field; I would not have thought of vaccinations and women's health without giving vaccinations to pregnant patients at the pharmacy.

Mai Vestergaard: This project prompted me to think critically about the impact our proposed study could have. The results from this study will reinforce the demonstrated efficacy of pharmacist-driven vaccination protocols while highlighting their effect in a previously understudied population. Beyond the short-term benefits of increasing influenza vaccination rates, this study could have long-term effects on clinical pharmacy utilization. This project has shown me how far-reaching a clinical pharmacist's role can be, inspiring me to consider broad career options.

Rapid Antibiotic Susceptibility Testing Platform for Direct Clinical Samples

Terrance Zhang '20 (Molecular and Cell Biology, CLAS; Biomedical Engineering, ENG)

Advisors: Joerg Graf, Professor, Molecular and Cell Biology; Guoan Zheng, Associate Professor, Biomedical Engineering

Supported by: OUR Supply Award

Project Summary

Infectious diseases and septicemia are two of the major causes of death in the U.S., necessitating rapid treatment of septic patients with proper, efficacious antibiotics. Unfortunately, the emergence and spread of multidrug-resistant bacteria are continuously being aggravated by an abuse in antibiotic prescription at a clinical and agricultural level. It is known that antibiotic resistance evolves through the sequential accumulation of multiple mutations in bacteria, which is accentuated by prolonged exposure of bacteria to ineffective antibiotics when implementing traditional septicemia treatment. The goal of this project is to develop a novel, easy-to-use AST platform for rapid antimicrobial susceptibility profiling to reduce the incidence and mortality rates, and to reduce inappropriate antibiotic usage commonly associated with invasive pathogens. As time progresses, antibiotic resistance becomes more prevalent and so does the need to effectively test antibiotics on any given bacteria strain in a timely manner. This project will utilize an E. coli bacteria and antibiotic plating method combined with a single-cell-level lensless imaging system to achieve this task. Here we propose a device that incorporates the working principle of a speckle-scanning pictographic lensless imaging scheme to visualize (in real-time) the growth of single cells of bacteria in a microscopic population under different antibiotic types and different concentrations of respective antibiotics. This system may further be optimized by directly imaging a blood sample, effectively bypassing the time it takes to perform traditional blood sampling, culture isolation, and culture propagation for antibiotic susceptibility testing. Our model organism will be Escherichia coli K-12 - a gram-negative facultative anaerobe with a generation time of 20-30 minutes.

Reflection on Learning

Many novel solutions to combating the rise of multidrug-resistant bacterial pathogens take one of two possible routes: Discovering/manufacturing a new therapeutic agent (e.g., antibiotic) or designing preventative measures (e.g., diagnostic tests). Effective implementation of an efficacious diagnostic measure can curb the rise of drug-resistance as a result of improper and incomplete treatment options. Many novel antibiotic susceptibility tests such as the Etest, agnostic real-time PCR, and automated scanning assays are based on the current Broth Microdilution gold-standard. However, delays in proper treatment for bacterial infections are mainly due to the need to draw patient samples, isolate bacterial agents, propagate the cells, and then assess antibiotic susceptibility profiles. By monitoring singular instances of fission in bacterial cells subjected to select antibiotics under a concentration gradient, we can drastically reduce the time of antibiotic susceptibility profiling down to the generation time of a given bacterial species. Furthermore, extrapolation of this design to utilize raw clinical blood samples will further decrease the time required for AST.

HMS Triton

James Zilvitis, Jr. '20 (Digital Media and Design, SFA)

Advisor: Matthew Worwood, Assistant Professor in Residence, Digital Media and Design

Project Summary

This project was done over the course of four semesters. It was done primarily in Autodesk Maya, with some work done in Adobe After Effects and Adobe Premiere as well as a brief interlude into Adobe Audition. It is a 3D model of an eighteenth century British Sixth Rate Frigate. It was done by building the model in Maya and then animating it frame by frame then edited in both After Effects and Premiere. The title sequences were all done in After Effects while the music was done in Audition and the final sequences were edited once imported into Premiere.

Reflection on Learning

With this lengthy project I've learned how to animate camera movements in Maya as well as editing individual framed elements created within Maya and then imported to other programs such as Adobe After Effects and Adobe Premiere as well as a brief interlude into Audition.

Online Materials: <http://1070.plesk.digitalmediauconn.org/bfashow/stamford/work-single.php?name=zilvitis>

Anxiety Contagion: Short-Term Physiological Impact of Interpersonal Stressor Between Best Friends

Izabela Zubrzycka '20 (Biological Sciences & English, CLAS)

Advisor: Kimberli Treadwell, Associate Professor, Psychological Sciences

Supported by: OUR Supply Award, PCLB Psychological Sciences Undergraduate Research Grant

Project Summary

This study sought to further explicate the role of social stressors on the impact of cortisol functioning. The role of a unique social stressor in the physiological stress response was explored in college students showing heightened anxiety, by examining its impact on physiological markers of stress, namely salivary cortisol levels, in a lab setting. Correlates with anxiety and depression were also noted at trait levels as well as in specific responses to the social stressor, and as they were linked to salivary cortisol levels. Participants engaged in conversation about personal worries with a close friend for 8 minutes, and provided salivary samples both before and after conversation. Participants also completed questionnaires measuring affect, depression, worry, anxiety, and friendship quality. It was hypothesized that following a personally relevant social stressor, cortisol level would increase from pre- to post-conversation for the primary participant (analogue GAD) as a direct effect of the stressor. The second hypothesis was that pre-conversation cortisol levels for all participants would be correlated with pre-conversation measures of emotional functioning; that is anxiety, depression, and negative affect. The third hypothesis was that both average and maximum heart rate would be higher as compared to their friend, but baseline heart rate would not be higher. Stress induction was successful, as participants reported an increased negative affect post-conversation, but there was no significant change in mean cortisol levels from pre- to post-conversation. However, there was a significant association between change in cortisol across the conversation and negative affect post-conversation.

Reflection on Learning

Engaging in this project has taught me about the multiple aspects of leading a research study, including budgeting, scheduling, and training. I have also learned how to read and analyze scientific papers, as well as write my own scientific paper (my thesis).

ADDENDUM

Formation of Elastin

Radi Elazazy '22 (Biomedical Engineering, ENG)

Advisor: Anna Tarakanova, Assistant Professor, Mechanical Engineering

Project Summary

Elastin is a protein that is essential to the elasticity of the elastic organs in our body such as the skin, heart, lungs, etc. The protein's elastic properties allows such organs to expand and contract. Elastin plays a crucial role and maintaining the structure of our skin, and pumping blood throughout our bodies. Unfortunately, mutations in the gene that creates elastin can cause diseases such as cutis laxa, Williams-Beuren syndrome, and supravalvular stenosis. These are diseases that prevent the elastin protein from working properly, and can result in heart problems and abnormally looking skin. This project is oriented around using computational methods to simulate the aggregation. The study of elastin aggregation is extremely elusive because it occurs on such a small time scale and a small size scale. This is why it is necessary to use computer simulations to study the process. My end goal with this project is to have contributed important information to the knowledge of elastin aggregation so we can move one step closer to treating the diseases that arise from problems in elastin aggregation.

Reflection on Learning

I am part of the spring 2020 IDEA Grant cohort. I will be working on this project this summer so I still have a lot to learn. I have worked on this project a bit already. I have already learned a lot about computer simulations and research. I have read many academic papers that have taught me an appreciable amount about the setting of academia, both inside and outside the world of computational chemistry and biology.

Examining Self Perception of Language and Cognition in a Non-Brain Injured Comparative Group

Kaleigh Frame '20 (Speech, Language, and Hearing Sciences & Spanish, CLAS)

Advisor: Jennifer Mozeiko, Assistant Professor, Speech, Language, and Hearing Sciences

Project supported by: SURF Award

Project Summary

To understand metacognitive abilities in people with aphasia (PWA), we must first understand the variability inherent in those without a neurological deficit. In the current study we examine the metacognitive skills of a non-brain injured (NBI) population to determine whether there exists a consistent pattern of metacognition by which to compare PWA.

Aims

1. Identify potential patterns of metacognitive functioning in an NBI group.
2. Compare the results from the NBI population to data collected from PWA (Wadams et al., 2019) to determine whether metacognitive patterns vary equally among PWA and NBI alike and whether task demand plays a role in accuracy.

We compared each of ten participants' confidence in several cognitive domains to their actual ability as measured by their performance on 1) Western Aphasia Battery-Revised (language test), 2) Informativeness in narrative discourse, 3) Several tests from the NIH toolbox (cognitive test), and 4) The Tower of London (executive function test).

NBI performed better on all cognitive tasks than PWA confirming literature that shows that cognitive deficits accompany aphasia impairments. NBI make similar estimations across task difficulty. These data do not support our hypothesis that task demands may influence the ability to estimate performance. We do observe variability in NBIs' ability to accurately estimate their cognitive ability, but this variability is much less than that of PWA. In the future we may consider this a preliminary benchmark in assessing people with metacognitive impairment.

Reflection on Learning

Through this project I gained an appreciation for research and its lengthy process. As I enter grad school to study to become a speech pathologist, I have a different perspective on the diagnostic and treatment methods I will learn. In addition to getting experience with people with aphasia as an undergraduate student, this project has helped me understand how to look for credible research.

Probiotic Colonization of the *Drosophila* Gut Is Influenced by Commensal Microbiota

Samantha Huebner '21 (Physiology and Neurobiology, CLAS)

Advisor: Nichole Broderick, Assistant Professor, Molecular and Cell Biology

Project Summary

In the Broderick Laboratory, I had the opportunity to utilize *Drosophila melanogaster* as a model organism, observing strains of gut bacteria which colonized the intestine and interacted with the microbiome. Specifically, I sought to quantify the growth of a known gut commensal: *Lactobacillus plantarum* (Lp) when co-administered with a probiotic strain of *Escherichia coli* (Nissle 1917, EcN) in vivo.

Research has shown that EcN affects human gut physiology as well, where it can compete with other bacteria, including pathogens such as Salmonella, making it a strain of interest with regard to human health. Additionally, previous in vitro experiments in the Broderick Lab showed that Lp inhibits the growth of EcN, and the degree of inhibition is dependent on the age of the Lp culture, as well as the physical distance between the organisms on the culture media. I replicated these experiments in vivo, in order to see if the same inhibitory phenotype was observed in the fly gut, and to understand how the gut microbiome influenced the growth of Lp and EcN.

In vivo studies involved the creation of gnotobiotic flies: Flies without gut bacteria (Axenic flies) were fed different combinations of Lp and EcN at varying times, allowed to incubate, and then the flies were homogenized in buffer, diluted, and plated to quantify gut bacteria density. Several trials revealed the following trend: Introduction of EcN after Lp had already colonized resulted in more EcN colonization, or less inhibition, than when EcN was introduced on the same day as Lp. This is contrary to previous results in vitro where the greatest inhibition of EcN occurred when EcN was plated later and the least inhibition of EcN was observed when Lp and EcN were both plated on Day 0. From this data it is likely that when colonizing the gut, the microbiome is an environment that allows Lp to secrete antimicrobial metabolites, to outcompete other strains attempting to colonize the gut simultaneously. After Lp has colonized the amount of metabolite secretion is reduced allowing EcN to colonize when exposed at later times. This hypothesis is a future direction in which mass spectroscopy would be utilized to determine the identity of Lp secretions.

Reflection on Learning

I first began research in this lab as a freshman and worked alongside a graduate student assisting her with various aspects of her project, learning techniques and studying *Drosophila* and the microbiome generally. Over the course of my sophomore and junior year I had the opportunity to work alongside my mentor, Alexander Barron, and develop my own question and experimental design. This has acquainted me with the scientific process. I have benefitted as a student and researcher from experiencing trial and error. Learning how to improve my methods, reduce error, and represent my data has been the most authentic way for me to grow my curiosity. This project has allowed me to collaborate as well as proceed as an individual. By working so closely with a mentor, I was able to understand various techniques in depth and truly engage with microbiology in a new way compared to my experiences in the classroom. I have also gained confidence in presenting and discussing my research with other scientists. This dialogue and feedback were a critical part of my research. As an individual I had the freedom to alter my project and methods; the data I presented in my project summary took nearly 9 trials over the course of several semesters. One of the main issues I experienced was cross-contamination and low growth; this led me to question how I could troubleshoot these errors and yield the most representative data. Analyzing in vivo growth and comparing my findings with previous in vitro data also showed that my initial hypothesis was not supported, which lent itself to developing the question 'why' and further encouraging me to continue asking questions of my own and with my mentor to develop an understanding of the relationship between the host microbiome and invasive bacteria.

Online Materials: <https://portfolio.com/entry/probiotic-colonization-of-the-drosophila-gut>

Environmental Ethics: An Intensive One-Semester Introduction for High School Students

Robin Rouleau '22 (Philosophy & Linguistics/Psychology, CLAS)

Advisor: Thomas Bontly, Associate Professor, Philosophy

Project Summary

"Environmental Ethics: An Intensive One-Semester Introduction for High School Students" is my partial solution to the problems of student disengagement and apathy concerning both environmental ethics and philosophy. This project entails the construction of a one-semester high school course which implores students to think critically about environmentalist philosophy and engage with environmentalist ideas in an affirming and constructive environment.

The final product of this curriculum will consist of a detailed week-by-week plan of study with extra time implemented in case of snow days and holidays. Each week will harbor specific readings, discussion questions, and, if applicable, project prompts. Each set of prompts will, for the purposes of student comprehension, include a sample project along with a set of pre-established rubrics which I will also construct. Along with these prompts, I will construct five sample lectures in total, providing a baseline as to how one may present topics in environmental ethics in a minimalist albeit thought-provoking manner. The course will consist of four units whose construction will be spread throughout the Summer. Possible units may include topics such as "The Beginnings of Environmental Ethics," "Intersectionality within Environmentalism," and "The Modern Age: Where Do We Go from Here?"

Upon the completion of the final product, a condensed version of the project will be presented during the Fall 2020 Frontiers poster exhibition. Even after this exhibition, however, I hope to work with state educators in implementing this curriculum.

This curriculum will not singlehandedly remediate student disengagement, nor will it rally students against climate change on a large scale. Such lofty ideals are not within my scope. Rather, this curriculum is a first step in normalizing environmental education within a high school environment, shifting it from the extraneous status of "other" and into American public consciousness. The world cannot afford to retain its ignorance, and in order to truly bring about legislative and educational reform, we must first work to destigmatize environmentalism, encourage environmentalist action on an individual scale, and clear up misconceptions which have been propagated by mainstream media. Even if only elements of this curriculum are implemented within a single school district, we will be one step closer to our end goal: a sustainable and safe existence.

Reflection on Learning

I have developed in two main ways during the course of this project:

Firstly, I have learned the value of constructing a work schedule for myself, especially during such strenuous times. Shortly following this project's inception, I felt lost; this feeling was due to a lack of long-term planning as to how I would work on the project. I now have constructed a weekly schedule for my work, setting solid deadlines without which managing such an endeavor would be difficult. Developing a sense of self-discipline has benefitted me immensely.

Secondly, this project has spurred me to investigate and critically analyze worldviews which differ from my own. Especially during the research phase of this project, I at times had trouble understanding and analyzing historical accounts of environmentalist ethics because their thought differed from my own. I am now more capable of synthesizing and contextualizing environmentalist philosophies, critically analyzing where they fall flat, and determining how I may constructively and non-judgementally implement environmentalist philosophy in other areas of my life.

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The background of the entire page is an abstract, marbled pattern in various shades of blue, ranging from deep navy to bright cyan, with thin, flowing veins of gold or yellow. The pattern resembles liquid paint or ink swirling together.

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