Clarkson University
The Community of Underrepresented Professional Opportunities
Research Journal — Summer 2022

Volume 11

Research is formalized curiosity. It is poking and prying with purpose.
— Zora Neale Hurston
Message from the CUPO Director

I am thrilled to showcase the summer 2022 Community of Underrepresented Professional Opportunities Scholars through our Journal Volume 11. This Journal shares the abstracts of all our scholars who completed a research experience this past summer. Their passion, hard work and dedication is reflected here, as well as the strong guidance and support they get from their faculty mentors. The journal also highlights the great successes of our alumni.

I would like to thank all the faculty who worked with scholars in this summer. Your time, dedication and commitment to the students, research and our program does not go unnoticed. We are very fortunate to have great faculty mentors guiding our students.

I would also like to thank the CUPO staff! Running a summer program of 33 scholars is not a small task. Deb’s hard work planning and running the program plays a huge role in its success. As well as Shannon’s dedication to the students and Professor Ramsdell’s commitment to matching each student with a faculty mentor and project.

Here are some CUPO facts of 2021-2022
CUPO served 386 students
100% STEM Majors

33 Summer Research Scholars completed 10 weeks of faculty guided research
They presented their research at Clarkson’s e-RAPS Conference
Attended weekly seminar speakers and graduate school prep workshops
18 took 8 week GRE Prep course and took the GRE Exam

McNair Fast Facts.....since 1996
98.8% Graduation Rate
39.3% Completed Master’s
12.9% completed PhD

National Facts
13% of people over 25 have a master’s degree
4.5% of Americans have a PhD

Marjorie Warden
Director
Community of Underrepresented Professional Opportunities
CUPO Staff and Location

Director: Marjorie Warden
mwarden@clarkson.edu

Assistant Director: Deborah Shipp
dgshipp@clarkson.edu

Assistant Director: Shannon Marlatt
smarlatt@clarkson.edu

Research Director: Prof. Michael Ramsdell
mramsdel@clarkson.edu

The Community of Underrepresented Professional Opportunities
CUPO

The CUPO office is located in New Snell 235
Phone: 315-268-6669
Fax: 315-268-6552
Email: cupo@clarkson.edu
http://www.clarkson.edu/mcnair
The Community of Underrepresented Professional Opportunities (CUPO)

The CUPO office is the shared home to the Collegiate Science and Technology Entry Program (CSTEP), the Ronald E. McNair Post-Baccalaureate Achievement Program (McNair) and the Louis Stokes Alliances for Minority Participation Program (LSAMP). The creation of this office brings together three long-standing federal and state Department of Education and National Science Foundation programs in one location, providing ease in access to services for students. The CUPO office provides academic enrichment, graduate school preparation, career and professional development, research opportunities, and social and cultural experiences for eligible students.

* **Academic Support:** academic advisement, private tutoring, academic success workshops, book grants, and laptop loans

* **Enriching Activities:** conferences, cultural and social activities

* **Career Development:** resume writing, professional skills workshops, guest speakers, industry visits, FE exam funding, job shadowing and internship/co-op guidance

* **Graduate School Preparedness:** faculty mentors, alumni speakers, research opportunities, conferences to present research, GRE prep, GRE exam support, graduate application assistance, funding to visit graduate schools and workshops
The Community of Underrepresented Professional Opportunities (CUPO)

**Collegiate Science and Technology Entry Program (CSTEP)**

Increases the number of historically underrepresented and economically disadvantaged students pursuing careers in STEM or licensed professions.

**Eligibility:** New York State resident. Underrepresented minority student who is in a STEM major or intends to enter a licensed profession.

**Funding:** NYS Department of Education and Clarkson University

---

**Louis Stokes Alliances for Minority Participation Program (LSAMP)**

Increases the number of students completing STEM degrees, increases the number of students matriculating into graduate programs.

**Eligibility:** African American, Hispanic, Native American, Pacific Islander; STEM major

**Funding:** National Science Foundation, the consortium comprises 7 institutions: Syracuse University (lead institution) and Clarkson University, Cornell University, Rensselaer Polytechnic Institute, Rochester Institute of Technology, and Monroe and Onondaga Community College

---

**Ronald E. McNair Post-Baccalaureate Achievement Program (McNair)**

Increases the number of historically underrepresented and economically disadvantaged students entering graduate school and obtaining their PhD.

**Eligibility:** Underrepresented minority students OR first-generation college students from a low-income background U.S. citizen or permanent U.S. resident, 2.8 GPA or higher sophomore or junior undergraduate.

**Funding:** A TRiO program funded by the U.S. Department of Education & Clarkson University
Student Highlight
Herbert Fountain

Herbert D. Fountain was born in Utica and raised on a dairy farm in Little Falls, NY. He left high school early to join The Clarkson School (TCS ’19) and graduated from Clarkson with a B.S in Biomolecular Science & Biology in May of 2022. While at Clarkson, Herb was heavily involved in research, working on a range of projects spanning experimental evolution, plant pathology, and alternative antimicrobials such as phage therapy. In the Spring of 2020, Herb completed a semester at the Trudeau Institute, in Saranac Lake, NY, where he helped to develop experimental SARS-CoV-2 and flu vaccines. Herb recently started his graduate education at Cornell in the Biological and Biomedical Sciences PhD program (fully funded as a McNair Fellow & Dean’s Scholar). Herb is now conducting experiments in regenerative medicine and anti-aging technologies, his ultimate goal is to dramatically extend human lifespan and end age-related diseases.
Pathea Bruno is from Queens Village NY and graduated from Iona University in December 2021 with a Bachelors in Biology: Cell/ Molecular Concentration. While an undergraduate at Iona, she spent 2 summers working with Clarkson’s McNair Scholars under Dr. Susan Bailey studying and researching the effects of antibiotics on dispersal rates of Pseudomonas Aeruginosa. In the second summer she was recognized for having the best undergraduate oral presentation in the Biomedical and Biomolecular Science: Genetics and Evolution category of Clarkson RAPS (2021). She has always been interested in science and enjoys the hands-on learning the labs provide. Currently she is pursuing a Ph.D. in Biochemistry at Clarkson University as a research assistant in the biochemistry and Proteomics Laboratory, led by Dr. Costel Darie. The research will use the proteins in breast milk to detect breast cancer cells and proteins using Mass Spectrometry. Although she is a Ph.D. student she also plans on earning an MD and working as an anesthesiologist.
## Research Mentors and Research Scholars

### Summer 2022

<table>
<thead>
<tr>
<th>McNair Scholars</th>
<th>Major</th>
<th>Faculty Mentor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jenna Briere</td>
<td>Biology</td>
<td>Shantu Sur</td>
</tr>
<tr>
<td>Nia Brown</td>
<td>Biology</td>
<td>Andreas Wilke</td>
</tr>
<tr>
<td>Eric Carlson</td>
<td>Mechanical Engineering</td>
<td>Kevin Fite</td>
</tr>
<tr>
<td>Isis Chernak</td>
<td>Biology</td>
<td>Ying Zhang</td>
</tr>
<tr>
<td>Luke Cowart</td>
<td>Chemistry</td>
<td>Devon Shipp</td>
</tr>
<tr>
<td>Jacqueline Ferrer</td>
<td>Chemistry</td>
<td>Mario Wreidt</td>
</tr>
<tr>
<td>Geline Franklin</td>
<td>Biology</td>
<td>Tom Langen</td>
</tr>
<tr>
<td>Yadhira Garcia</td>
<td>Psychology</td>
<td>Andreas Wilke</td>
</tr>
<tr>
<td>Dawit Gebremichael</td>
<td>Math</td>
<td>Sumona Mondal</td>
</tr>
<tr>
<td>Vy Huynh</td>
<td>Aeronautical Engineering</td>
<td>Michael Bazzocchi</td>
</tr>
<tr>
<td>Sakena Kearse</td>
<td>Psychology</td>
<td>Ying Zhang</td>
</tr>
<tr>
<td>Isaac Kiiza</td>
<td>Math</td>
<td>Seema Rivera</td>
</tr>
<tr>
<td>Jessica Mendoza</td>
<td>Neuroscience</td>
<td>Sean Banerjee</td>
</tr>
<tr>
<td>Aida Neres</td>
<td>Biology</td>
<td>Kenneth Wallace</td>
</tr>
<tr>
<td>Camryn Shirley</td>
<td>Chemistry</td>
<td>Alicia Grosso</td>
</tr>
<tr>
<td>Aaron Usher</td>
<td>Chemistry</td>
<td>Mario Wreidt</td>
</tr>
<tr>
<td>Irving Vielma</td>
<td>Computer Science</td>
<td>Sean Banerjee</td>
</tr>
<tr>
<td>Tyra Volney</td>
<td>Forensic Science</td>
<td>Alicia Grosso</td>
</tr>
<tr>
<td>Danna Wang</td>
<td>Chemistry</td>
<td>KaHo Leung</td>
</tr>
<tr>
<td>Sean Willis</td>
<td>Mechancial &amp; Aero Engineering</td>
<td>Sean Banerjee</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CSTEP Scholars</th>
<th>Major</th>
<th>Faculty Mentor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mariah Benavides</td>
<td>Chemical Engineering</td>
<td>Mario Wreidt</td>
</tr>
<tr>
<td>Javier Boatman</td>
<td>Physics</td>
<td>Arzu Colak</td>
</tr>
<tr>
<td>Samantha Cannata</td>
<td>Psychology</td>
<td>Ying Zhang</td>
</tr>
<tr>
<td>Aboubakar Dabre</td>
<td>Biology</td>
<td>Ginger Hunter</td>
</tr>
<tr>
<td>Ivy Dong</td>
<td>Chemistry</td>
<td>Silvana Andrescu</td>
</tr>
<tr>
<td>Cayden Fernandez</td>
<td>Chemical Engineering</td>
<td>Devon Shipp</td>
</tr>
<tr>
<td>Auden Hope</td>
<td>Aerospace Engineering</td>
<td>Craig Merret</td>
</tr>
<tr>
<td>Tenzin Kinzom</td>
<td>Biology</td>
<td>Kenneth Wallace</td>
</tr>
<tr>
<td>Skylar Schmitt</td>
<td>Biology</td>
<td>Alicia Grosso</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LSAMP Scholars</th>
<th>Major</th>
<th>Faculty Mentor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arletty Arias</td>
<td>Biology</td>
<td>Susan Bailey</td>
</tr>
<tr>
<td>Anthony Caraballo</td>
<td>Physics</td>
<td>Joshua Thomas</td>
</tr>
<tr>
<td>Rose Cotto</td>
<td>Environmental Science</td>
<td>Tom Langen</td>
</tr>
<tr>
<td>Junior Tchapdieu</td>
<td>Aerospace Engineering</td>
<td>Michael Bazzocchi</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Faculty Mentor</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Shantu Sur</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Andreas Wilke</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kevin Fite</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ying Zhang</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Devon Shipp</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mario Wreidt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tom Langen</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Andreas Wilke</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sumona Mondal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Michael Bazzocchi</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ying Zhang</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seema Rivera</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sean Banerjee</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kenneth Wallace</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alicia Grosso</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mario Wreidt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sean Banerjee</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alicia Grosso</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KaHo Leung</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sean Banerjee</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mario Wreidt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arzu Colak</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ying Zhang</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ginger Hunter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Silvana Andrescu</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Devon Shipp</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Craig Merret</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kenneth Wallace</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alicia Grosso</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Susan Bailey</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Joshua Thomas</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tom Langen</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Michael Bazzocchi</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Abstract:

Anticancer peptides are rapidly gaining attention because they do not lead to the development of drug resistance, a major limitation for most chemotherapeutic agents. Weakly cohesive assembly of cationic peptide amphiphiles (PAs) was previously shown to cause cell death by membrane disruption, however, recent work from our group with a slightly different PA design suggests the involvement of a regulated cell death mechanism. In this work to better understand the interaction between PA and cells, we investigated the long-term response of cervical cancer cells to a single sub-lethal exposure to PA (10 micro-molar). Upon treatment, the cells were analyzed using confocal microscopy. Fluorescently tagged PA was found to interact with the cell membrane and become internalized upon treatment. After PA treatment was removed from the cell media, subsequent confocal imaging was performed to uncover the long term effects of a single PA treatment overtime. Information regarding PA internalization, including the number of particles internalized, will be deciphered. Along with analyzing the morphological changes and characterizing cell-PA interactions, gene expression of PA treated cells will be assessed using quantitative PCR (qPCR). Intracellular signaling
Statistical Thinking in Children

Nia Brown

Abstract:

Previous research suggests that the hot hand phenomenon, a tendency to perceive illusory streaks or clumps in random sequences of data, is a human universal tied to humans’ evolutionary history of foraging for clumpy resources. Our current research investigates how misperception of randomness and ecologically relevant statistical thinking develops ontogenetically. The assumption of clumpy resource distributions could be part of a developmental program that only comes online later in adolescence or adulthood or it might already be present in the early years of life. Based on our work with adults, we developed three iPad-based decision-making tasks to assess how 3-10 year-old children decide that sequential events will continue in a streak or not (Task 1: The animal foraging task), their understanding of randomness (Task 2: The raindrop task), and their ability to reason in spatially dependent terms (Task 3: The tree task). In the first task, a cartoon animal travels down a line of resource spots and the children have the opportunity to predict the presence or absence of food one resource spot at a time. In the second task, children create a distribution of raindrops as they expect them to fall on an outdoor basketball court. In the third task, children will be asked to place individual resources on a tree. There will be spatially positive conditions (e.g., apples) as well as spatially negative conditions (e.g., birds). Where people see predictable patterns versus randomness determines how they will interact with the world, including how they search for resources in stochastic environments. Understanding the development of such perceptions has applications in numerous important daily domains. Our results will inform better methods of science education for helping children (and students) to more accurately recognize what are likely patterns and what is random. A sound understanding of randomness is central to teaching statistics, informs our decision-making processes, and provides guidance when facing judgements under risk and uncertainty. Our study is run in collaboration with the SUNY Potsdam Child Care Center (SPCCC), the North Country Children’s Museum (NCCM), and the Max Planck Institute for Human Development in Berlin, Germany. Funding is provided by a grant from the National Science Foundation (NSF).
Design and Experimental Characterization of a Lower-Back Exoskeleton for Firefighters and First Responders

Eric Carlson

Abstract:
The physical nature of tasks performed by firefighters and emergency medical technicians (EMTs) results in an increased risk of injuries in the field. It is reported that 30% of Firefighters and 36% of EMTs reported lower back disorders due to injuries on the job. The fire departments in the United States are a vital public service that assists people in times of crisis, not just in fighting fires but also in assisting in disaster aftermaths, emergency medical evacuations, search and rescue, and other lifesaving response efforts. When individuals overexert themselves physically, the likelihood of injury increases. Lower back disorder is one of the largest consequences of overexertion, and an estimated 60% to 85% of adults will experience acute or chronic lower back pain. The objective of this effort is the development of an exoskeleton system for use by firefighters and EMTs. Focus sessions were conducted with first responders to determine end-user needs and exoskeleton design specifications. It was found that the primary considerations should focus on a lightweight and comfortable system that can provide postural support without being overly burdensome to don and use effectively. There are two primary types of exoskeletons: passive and active. An active exoskeleton incorporates external power and actuation whereas a passive exoskeleton provides energy storage and/or dissipation but without the ability for net-positive power generation. Given the needs of first responders, this effort focused on the development of a passive exoskeleton system constructed using soft and flexible materials that can be worn underneath or integrated within the user’s existing uniform. Textile-based prototypes were fabricated, and preliminary experimental characterizations were conducted to evaluate their efficacy in providing postural support to the lower back.
Risk Factors, Prevention, and Screening Practices of Post Partum Depression in Black and Latina Mother’s Based on Socioeconomic and Cultural Values

Isis Chernak

Abstract:
Postpartum depression (PPD) is a crippling mental disorder that affects millions of women each year in the United States. This study is a literature review that assesses the risk factors, treatment, and screening practices for PPD and how they affect the minority groups of Black and Latina mothers. Databases such as the University at Albany’s Library, Clarkson University’s Library, and Google Scholar were used to search peer reviewed journal articles from 2006-2021 in English on the topic of PPD. Keywords related to the treatment, screening, prevention, and risk factors of PPD were used as a search strategy to obtain articles. The review of the 19 articles has shown that Black and Latina mothers are screened at lower rates and suffer from PPD at higher rates than their white counterparts. This can be attributed to related socioeconomic risk factors such as financial stability, immigration status, and cultural values for Black and Latina mothers. Limited resources for screening and treatment due to social barriers associated with environment can further put this group at a disadvantage. Due to this, treatment options such as antidepressants for PPD are limited and less appealing to this underrepresented demographic. Cost effective and nondrug related options such as cognitive behavioral therapy, psychotherapy, texting, and peer support are preferred by Black and Latina mothers to help prevent and treat PPD are shown to be just as effective as antidepressants. With greater options, knowledge and fulfillment of proper screening practices and treatment, the prevalence of Black and Latina mothers with PPD can be decreased. This study could inform the innovation and implementation of screening tools and prevention factors that can aid in diagnosing and treating Black and Latina mothers with PPD.
Drug Release from the Surface-Erosion of Poly(methacrylic Anhydride) (PMAA)

Luke Cowart

Abstract:

Poly(methacrylic anhydride) (PMAA) surface erodes over time when placed in aqueous environments which can be used to release drugs and other therapeutic agents, lidocaine as the model drug. The amount of lidocaine (or other localized) in each sample can be adjusted to the desired amount needed for the application. In the human body, this type of degradable polymer could be used as an excellent bone cement bio-adhesive or bio-cement and because as it degrades it still maintains its mechanical properties along with the same time as releasing localized medication into the desired area. This allows the polymer to break down and dissolve away, ideally at the same rate as then the bone tissue heals and can grow back into place. While at the same time lowering the pain and inflammation by using releasing localized medication that could numb up the area or enhancing healing by rigidifying the wound and potentially also releasing growth factors. To be able to make this, Ideally, such polymers need to have customizable erosion rates and breakdown in a desired time line that aligns with the wound healing process. Erosion rates are dependent on several factors, including monomer conversion (to polymer), thermal and mechanical properties, and polymer composition and microstructure. Thus, the present research examines testing if post-polymerization annealing the compound of PMAA would increase monomer conversion and thus make a difference to erosion rates. This is explored using PMAA samples that are analyzed using infrared (IR) spectroscopy and monitoring of erosion in phosphate buffered saline (PBS) solution at 37 °C. It was found that annealing it does not have a significant effect on the degradation process. Even though the percent monomer conversion is much higher in the annealed sample. Therefore, the annealing is not effective in prolonging the degradation process. Preliminary drug release data was collected. Therefore in the future, we can use PMAA can be potentially used in order to create a customizable product for helping people the healing of tissue injuries broken or fractured bones.
Selective Adsorption of Anionic Water Contaminants using a Novel Porous Organic Polymer

Jacqueline Ferrer

Abstract:
Removing aqueous contaminants from groundwater is a process that has proven to be difficult due to the complex variety of toxic pollutants. Adsorption of these aqueous contaminants is commonly performed using adsorbents such as activated carbon and ion-exchange resins, which have low adsorption capacities and slow kinetics. Many of these contaminants have anionic functional groups, allowing for the design of specific adsorbents with affinity for capturing these groups. Porous organic polymers are a class of porous materials that can be designed with large pores and high surfaces areas, and have been shown to be an excellent sorbent for small molecules. In this work, a novel cationic porous organic polymer (CPOP) is used to investigate the adsorption of various anionic contaminants. Three different categories of contaminants were investigated including carcinogens, toxic dyes, and pharmaceuticals. Quantitative analysis using UV-Vis spectroscopy was performed to analyze the kinetics and maximum adsorbance capacity for each of these contaminants in the CPOP.
Presence of Parasites in the Invasive Species of Cipangopaludina chinensis

Gelinge Franklin

Abstract:

Cipangopaludina chinensis, or the Chinese mystery snail, is an invasive species that is native to Asia, and was first introduced in California in the year 1892. Chinese mystery snails compete for the same resources as native snails, and can carry parasites that are not native to the introduced range. Nonnative parasites can cause damage to the antive ecosystem, as it may not be prepared to protect themselves from the threat. We hypothesized that snails larger in size will host more internal parasites compared to snails that are smaller in size. We collected 50 Chinese mystery snails by hand, all varying in size, from 3 different bodies of water in the Potsdam area. To investigate our hypothesis, we performed heat-lamp treatments and analyzed water in which parasites were shed under compound microscopes. Detected parasites were collected using a pipette, preserved, and will have their DNA extracted for identification. By investigating whether numbers of parasites increase with body size, we can evaluate whether larger snails potentially have a bigger impact on the native ecosystem’s snails because of their higher parasite load. Further studies will characterize these types of parasites using DNA sequencing, as well as their impact on the native snail population.

Geligne (Ju-lean) Franklin is from the Silver Spring, Maryland and grew up in the DC area. This upcoming semester, she will be entering her senior year, studying forensic biology at Delaware State University in Dover, Delaware.

Her focus this summer was invasion biology of the invasive species of the Chinese Mystery snail, or Cipangopaludina chinensis. More specifically, studying the parasites that they carry through heat-lamp experiments and live dissections. She studied with Dr. Tom Langen and Nimanthi Abeyrathna in the biology department.

Other than research and studying, Geligne plays on the Delaware States women’s soccer team, and has been on the team since her freshman year. She also enjoys drawing and improving her artistic abilities and creating art.
Abstract:

Previous research suggests that the hot hand phenomenon, a tendency to perceive illusory streaks or clumps in random sequences of data, is a human universal tied to humans’ evolutionary history of foraging for clumpy resources. Our current research investigates how misperception of randomness and ecologically relevant statistical thinking develops ontogenetically. The assumption of clumpy resource distributions could be part of a developmental program that only comes online later in adolescence or adulthood or it might already be present in the early years of life. Based on our work with adults, we developed three iPad-based decision-making tasks to assess how 3-10 year-old children decide that sequential events will continue in a streak or not (Task 1: The animal foraging task), their understanding of randomness (Task 2: The raindrop task), and their ability to reason in spatially dependent terms (Task 3: The tree task). In the first task, a cartoon animal travels down a line of resource spots and the children have the opportunity to predict the presence or absence of food one resource spot at a time. In the second task, children create a distribution of raindrops as they expect them to fall on an outdoor basketball court. In the third task, children will be asked to place individual resources on a tree. There will be spatially positive conditions (e.g., apples) as well as spatially negative conditions (e.g., birds). Where people see predictable patterns versus randomness determines how they will interact with the world, including how they search for resources in stochastic environments. Understanding the development of such perceptions has applications in numerous important daily domains. Our results will inform better methods of science education for helping children (and students) to more accurately recognize what are likely patterns and what is random. A sound understanding of randomness is central to teaching statistics, informs our decision-making processes, and provides guidance when facing judgements under risk and uncertainty. Our study is run in collaboration with the SUNY Potsdam Child Care Center (SPCCC), the North Country Children’s Museum (NCCM), and the Max Planck Institute for Human Development in Berlin, Germany. Funding is provided by a grant from the National Science Foundation (NSF).
Analysis of Asteroid Properties for Yarkovsky Deflection

Vy Huynh

Abstract:

The Yarkovsky effect is a small photonic force that affects the orbital motion of an asteroid. When an asteroid heats up in the sun, the asteroid re-radiates the energy causing a small thrust that is miniscule compared to gravitational forces but crucial to an asteroid’s orbit. The Yarkovsky effect is dependent on many variables such as the shape, surface roughness, spin, bond albedo, and obliquity of an asteroid. The Advanced Thermal Physical Model (ATPM) was chosen to analyze desired asteroids because it is the most accurate model. The ATPM incorporates other properties such as the surface roughness that were not included in previous models, and the Yarkovsky effect has been computed for specific asteroid targets with the ATPM, which makes it a preferable model to incorporate in this research. The ATPM utilizes triangular facets for computational modeling. Knowing the sensitivity of the ATPM (thermal inertia, rotation period, bond albedo), a deep space mission to an asteroid will be calculated. The goal of this research is to alter an asteroid’s parameters such as surface roughness or bond albedo to determine the semi-major axis drift.
Measuring Self-Regulation in Cultural Contexts: A Scoping Review of the Measures in Children

Sakena Kearse

Abstract:
Self-regulation is one’s capability to enable children to respond to specific situations acceptably and appropriately. This ability is vital in understanding the differences in children’s behaviors and reactions. Researchers have conducted studies measuring self-regulation and have developed many different measurements for children. Unfortunately, there has been little research that reviews these measures for self-regulation in children, beyond relying on samples from White children only. Therefore, this scoping review systematically reviews the empirical articles measuring self-regulation in children between 2000 - 2022. This review is needed to give insights to the need of updating measures on self-regulation so that it could be valid for children from Black and Latinx backgrounds. The literature search was conducted using several different databases such as PsychNet and Google Scholars. During this search, particular keywords (self-regulation, children, and questionnaires) were used to search articles with the primary focus of measuring self-regulation in children. The search yield 15 articles, and after the abstract screening, 10 articles were included in the analyses. Findings suggest that questionnaires have been the most common and successful approach but the questions are not for a group-by-group scenario. The Self-Regulation Questionnaire (SRQ) was validated using children in preschool years from many different cultures. Many questionnaires found used the same questions which may have limited the best responses in some children. Specifically, questions on a questionnaire for children that identify as Latin should differ from the ones asked for a Black or White child. For example, the SQR was used in a study that later identify the Rasch model not being a good tool when it came to measuring self-regulation in Spanish-speaking children. (Pichardo et al.,

Sakena Kearse is from New York City and is studying Psychology with a minor in Biology. She is a rising Junior and has been focusing on the emotional functions in early childhood for research this summer. She has been working closely with Dr. Zhang and they have specifically focused on the self-regulation levels in children. When Sakena is not in the lab, she could be spending time with friends or working closely with others in one of the organizations on campus she is a part of. While doing research this summer Sakena was a RA for the SPREE program hosted by the High Education Opportunity Program. Overall, Sakena enjoys being able to work with others and help whenever she can.
Abstract:

The scarcity of teachers in Science, Technology, Engineering, and Mathematics (STEM) that exists in most K-12 schools across the country is even more common in rural areas. Additionally, recruitment, retainment, and persistence in rural areas are difficult; these small communities are tied to less funding, which results in lower teaching salaries, higher poverty rates, geographic isolation, and a limited pool of potential applicants. The purpose of this research is to determine whether or not training educators to work in rural areas is an act of educational justice. We critically examined two Noyce Scholars, Corbin and Levi, throughout our research by conducting virtual interviews with them over Zoom and analyzing their journals and surveys using the Dedoose application. According to the findings of this study, training Corbin and Levi played a significant role in their success teaching in rural schools. Hence, it is educational justice for institutions to prepare students to teach in rural areas.
Virtual Roller Coaster

Jessica Mendoza

Abstract:

A Phobia, the fear of something, that is shared by many is acrophobia, which is the fear of heights, and affects daily life. This research aims to discover if it is possible to approach acrophobia virtually with roller coasters. This research offers the customization and control of virtual reality with the full-body movement of traditional coasters to aid in data collection and participant comfortability. The research relies on using surface electrocardiogram (sEKG) and surface Electromyography (sEMG) tools to collect data from participants. We use the MaxFlight VR2002 rollercoaster simulator to address phobias, specifically acrophobia, in a controlled environment. Inside the simulator, we install multiple sensors, including the Azure Kinect DK color and depth camera, and the Sierra-Olympic thermal camera. Thermal imaging may also play a role in collecting data from heat signatures. We obtain the patient's heart rate using the Polar H9 chest-strap heart rate sensor. In addition, we use Delsys sEMG sensors to determine anxiety levels based on the right and left trapezius muscles for muscle activation and tension levels. We use this information to determine if the simulated environment compares to the real-world roller coaster stress levels to approach a systematic desensitization therapeutic approach for acrophobia. Over the summer, we became familiar with the coaster, developed protocols for future studies, and collected data that will be used to optimize the coaster’s motion. For future studies, we hope to capture the data on patients’ experiences on the rollercoaster.
Organization of the Zebrafish Intestinal Stem Cell Compartment

Aida Neris

Abstract:
The base of the adult intestine folds contains stem cell niches. Within these niches, stem cells proliferate. Stem cell progeny differentiate into a mix of enterocytes and secretory cells as they move up the fold and apoptosis at the top of the fold. However, less is known about the organization of the zebrafish stem cell compartment. Within mammals stem cells are at the crypt base interdigitated by Paneth cells. Progeny of stem cells moves up to the transient amplifying zone where cells begin differentiating into enterocytes and secretory cells. We suggest that there may be a similar organization at the zebrafish fold base. Researchers have recently performed single-cell sequencing of the six-day post fertilization intestine and identified two progenitor cells (progenitor-like 1 (P1) cells, and progenitor-like 2 (P2)). We are interested in using markers of these cell types to identify the physical organization of these cells in the stem cell niche. We have cloned portions of the top differentially expressed genes for P1 and P2 for use in RNA in situ hybridization. P1 or P2 may be the stem cell while the other may represent a transient amplifying population. The organization of P1 and P2 within the intestine will begin to understand organization.
Using Geometric Morphometrics to Measure Scoliosis and the Impact on the Human Pelvis

Camryn Shirley

Abstract:
Scoliosis is a medical diagnosis that affects about three percent of the world. In order to diagnose scoliosis physicians must discover a Cobb Angle of 10 degrees or above in patients. Although this is a common practice, many physicians and researchers do not know how to measure Cobb Angles in the spine accurately. We discover unique ways to create accurate measurements of Cobb angles with technology such as Dragonfly and GIMP with CT scans from the New Mexico Decedent Identification Database. With the completed CT scans, we created 3D models to analyze the discrepancies individuals with scoliosis may have on their pelvis compared to those without scoliosis in a program called Checkpoint. For future development with this study, we hope to explore more impacts on the body such as the knees.

Camryn Shirley is originally from Frankfort, IL. She attends University of Illinois at Urbana-Champaign and studies Community Health and Chemistry.

During her time completing the McNair Scholar Program at Clarkson University, she researched the impact of scoliosis on the human pelvis. In addition, she also analyzed new techniques to measure the cobb angle in the spine.

She hopes to obtain her masters in Public Health with a concentration in Epidemiology then continue her education at New York University Medical School. Camryn is also a member of Alpha Kappa Alpha.
Abstract:

Metal-organic frameworks (MOFs) are porous crystalline materials made from the self-assembly of metal ions or clusters and organic linkers forming multidimensional porous frameworks with high surface areas. MOFs have been shown to be excellent sorbents for many environmental applications including water harvesting and adsorption of water contaminants. Zwitterionic ligands can help improve the MOFs’ adsorptive properties by increasing the amount of electrostatic binding sites in the MOF pores. Developing design strategies for synthesizing water stable MOFs is a necessary component of specific advancement of MOFs for these applications. In this work, multiple synthesis strategies are employed to support high throughput analysis of new zwitterionic MOFs resulting in new lab standard operating procedures for MOF discovery. Various analytical techniques including single-crystal and powder X-ray diffraction are employed to investigate MOF synthesis.
Virtual Reality Coaster on Phobias

Irving Vielma

Abstract:
Roller coasters are a common source of amusement for many, but great fear for many others. Traditional methods of overcoming these fears usually entail systematic desensitization, either by direct exposure to coasters or through virtual reality. We provide a middle ground to these two approaches, offering the customization and control of virtual reality with the full-body movement of traditional coasters. We use the MaxFlight VR2002 rollercoaster simulator to address phobias of rollercoasters in a controlled environment. Inside the simulator, we install multiple sensors, including the Azure Kinect DK color and depth camera, and the Sierra-Olympic thermal camera. We obtain the patient’s heart rate using the Polar H9 chest-strap heart rate sensor. In addition, we use Delsys sEMG sensors to determine anxiety levels based on particular muscle activation levels. We use this information to determine which situations cause the patient to feel anxious and stressed. Over the summer, we became familiar with the coaster, developed protocols for future studies, and collected data that will be used to optimize the coaster’s motion. For future studies, we hope to capture the data on patients’ experiences on the rollercoaster.

Irving is from New York City and is a rising junior studying computer science at Le Moyne College.
This summer Irving explored how research can use a simulator to treat phobias/fears related to full-body experiences like rollercoasters and flying. Also he tried to identify what sorts of control can be made to make them more comfortable, and whether or not they're effective.
Irving hopes to further his studies and obtain a masters degree from Carnegie Mellon University in computer science. His hobbies include traveling and hanging out with his friends.
The Effect of Sediment Abrasion and Water Velocity on Saw-Mark Characteristics of Bones in Dismemberment Cases

Tyra Volney

Abstract:

In criminal cases where bodies are dismembered to conceal or alter evidence, saws are commonly the tool of choice. Recent research has developed standard terminology for saw mark features like tooth hop, exit chipping, breakaway spurs, and pull-out striae which can help determine saw class characteristics such as tooth size, tooth set, tooth shape and saw power. Saw mark evidence might be associated with remains that have also been exposed to fire, soil, and water environments, all commonly employed methods to hide criminal acts. In this study, four experimental groups of sawed pig humeri were placed in flumes for 24, 48, 72 and 96 hours to determine whether the ability to recognize and measure tooth size evidence from bone would be affected by abrasion of the bone by sediment. Features including tooth hops, exit chipping, breakaway spur presence, and pullout striae were counted and measured by two observers of different experience on each sawed surface before and after the experiment using a Leica M165C stereomicroscope. Sediment in the flume was considered sandy, with water velocity approximately 1.03 m/s. Control groups were in a flume lacking sediment, while maintaining same velocity. The effect of abrasion was determined using a one-dimensional profilometer (Mitutoyo SJ-410) to calculate the roughness of each surface before and after the experiment. This study shows that saw count varied before and after between observers, with bone staining from the flumes enhancing or hindering an observer’s findings. Preliminarily and counter to initial hypotheses, sediment adhered to the surfaces, visually appearing grainier under the microscope; however, this is limited to sand, as well as duration and velocity selected for this experimental study. A total of 268 tooth hops were identified by observer 1 and 247 by observer 2 prior to the experiment. Post experiment, the number of tooth hops identified increased by 16.79% for observer 1 and decreased by 29.15% for observer 2. Exit chipping was identified on 95.83% and 93.75% of surfaces according to observer 1 and 2. Post-experiment, these numbers decreased by 18.75% and 2.08% respectively.

Tyra Volney is originally from Saint Lucia, but studies in New York City at John Jay College of Criminal Justice, majoring in Forensic Science. Her research this summer focuses on the effects of sediment abrasion on the ability to identify tooth size characteristics of saw marks on bones. She plans on pursuing a PhD in Forensic Science.
Effect of Cl- channel inhibitors in cGAS-STING pathway

Danna Wang

Abstract:
Chloride ions are regulated by intracellular chloride channels or transporters. Chloride homeostasis is important for cells and mediates a lot of cell functions such as neutral pH. One of the pathways we’ve been studying is called the cGAS-STING pathway. The cGAS-STING pathway occurs in the innate immune system in human's body. The purpose of cGAS-STING pathway is to detect the cytosolic DNA inside the cell. After it detects the DNA, active TBK1 and IRF3 by attaching a phosphorus group to it. Which triggers the production of inflammatory cytokines and inflammatory response. We herein investigate the effect of whole cell chloride dysregulation (by using different non-selective chloride channel inhibitors, such as 4,4′-Diisothiocyano-2,2′-stilbenedisulfonic acid and N-phenylanthranilic acid) towards this pathway. The discovery of this project will contribute to the chloride channel targeted therapy for auto-inflammatory disease.

Danna Wang is from Nashua, NH. She is a rising Senior from Clarkson University, with double majors in Biomolecular Science and Chemistry, and a minor in Biology. During the Summer, the research that she is involved in is related to the STING pathway. Based on the drug it can block various parts of the STING pathway. Also, based on the compound that she analyzes by using the fluorescence, if the compound is quenching with chloride, then it can be used in the cell to test the STING pathway as well. After she graduates from Clarkson University, she wants to continue pursuing a PharmD degree by attending a pharmacy school.
Collecting a High/Low-Resolution Dataset for Object Grasping

Sean Willis

Abstract:

For a robotic armature to manipulate real-life objects, current artificial intelligence algorithms require a large amount data on object’s geometry, relative location, and relative orientation. Such data sets are quite limited, with this work serving to help remedy this. We collected 330 RGB-D cluttered scenes of about 10 objects (out of 254 unique objects). Each scene has 3 clutter densities, defined by 3 circles of varying radii. 2 Kinova gen3 7DoF robotic armatures captured the scenes using a Kinect and RealSense to create 2 hemispheres with differing radii. This totaled to 443,520 color and depth images that we individually validated for errors, e.g., missing images, color swapping, depth image inaccuracies. Afterward, we determined the pose of each object by manually aligning the object’s model to the scene point cloud for all 3 cluttered densities using an inhouse annotation program.
Optimization of the in-gel trypsin digestion for proteomics applications

Mariah Benavides

Abstract:

Metal organic frameworks (MOFs) consist of metal ions connected by organic ligands. Their porous structure and overall unique characteristics resulted in their chemical stability, pore size/shape tunability and encapsulation efficiency of active ingredient molecules. The objective of this research project is to synthesize and characterize UV filter loaded MOFs based on cyclodextrin (CD). The as-synthesized UV filter encapsulated cyclodextrin MOFs namely UV filter@CD-MOFs showed excellent photostability in contrast to the free AVB and are capable to eliminate the photo-degradation of the UV filter. Owing to the strong UV filter confinement due to strong supramolecular interactions at the UV filter-MOF interface (hydrogen bonding and hydrophobic interactions), such MOF based sunscreens are expected to protect the skin from direct contact with harmful UV filters (that may cause damage such as genotoxicity). More interestingly, such UV filter@CD-MOFs are anticipated to reduce the ROS production and thus no transdermal penetration of UV-filter takes place due to MOF confinement effect. We have used the CD MOFs such as β-cyclodextrin MOF4 or β-CD MOF and γ-cyclodextrin MOF5 or (γ-CD MOF) for the synthesis of UV filter@CD-MOFs due to the biocompatibility, tunable pores, high surface area and high

Mariah Benavides currently lives in Long Island, New York. Mariah is attending Clarkson University as an undergraduate student in her senior year. She is majoring in Chemical Engineering with a minor in Biomedical Engineering. She pursues her research with Dr. Mario Wriedt’s research group in the Functional Materials Design & X-ray Diffraction Laboratory. Her research interests involve working with advanced functional porous materials for medicinal applications. The research project Mariah partakes in is funded by Estée Lauder to develop advanced sunscreen materials. Mariah plans on pursuing a master’s degree at Manhattan College with their M.S. Option in Cosmetic Engineering program. In Mariah’s free time, she enjoys playing basketball with her teammates and friends.
Friction of Ti$_3$C$_2$T$_x$MXene at the nanoscale—the impact of probe material

Javier Boatman

Abstract:
Friction is a force that appears in mechanical systems as they interact and move against each other. About 20% of the global energy is lost due to overcoming friction. Therefore, with the prospect of cost and energy savings, new materials and various lubricants have been developed to use on the interacting surfaces of mechanical systems. Liquid lubricants (such as oils and greases) are typically what come to mind when someone thinks of lubrication. However, certain operating conditions like extreme temperatures or pressure can prohibit using the liquid lubricants as they might evaporate or solidify. In such conditions, solid lubricants, which are two-dimensional (2D) layered materials with low shear strength, are used to reduce the effect of friction. Recently, it was shown that 2D layered materials of early transition metal carbides/nitrides/carbonitrides, as so-called MXenes, could have a potential of being used as solid lubricants due to their easy-to-shear ability, enhanced intra- and interlayer bonding characteristics. In this study, we experimentally investigate the nanoscale friction property of titanium carbide (Ti$_3$C$_2$T$_x$) MXene layers with atomic force microscopy (AFM). The measurements were performed in a dry nitrogen environment by sliding either SiO$_2$ or diamond-like-carbon (DLC) AFM probes against Ti$_3$C$_2$T$_x$ MXene with varying layer number (1-4) to investigate the impact of -O or -C groups on probes to the measured friction of Ti$_3$C$_2$T$_x$ MXene. We have found that the nanoscale coefficient of friction (COF) of Ti$_3$C$_2$T$_x$ MXene was slightly higher when measured with SiO$_2$ probes, but still ultra-low, i.e., superlubric. For both probes, COF of Ti$_3$C$_2$T$_x$ MXene was depending on the number-of-layers, and was decreasing with increasing layer number from single- and four-layer. These results reveal the potential of Ti$_3$C$_2$T$_x$ MXenes as excellent lubricants at the nanoscale.

Javier Boatman is from Syracuse, New York. He is a physics major and an upcoming sophomore at Clarkson University. His research consisted of scanning a material named Ti$_3$C$_2$T$_x$ MXene using a process known as atomic force microscopy. A machine called an atomic force microscope looks at the material on the atomic scale and his research was more specifically the effect of the scans on the material with different types of scanning tips. He plans on getting a PhD in the future but for what is unknown. He enjoys playing the guitar and the piano as well as enjoying quality time with his friends and family.
Abstract:

The ability to monitor and manage emotions, thoughts, energy states, and behaviors in ways that are acceptable and produce positive results such as well-being, loving relationships, and learning comes from a solid foundation in self-regulation. This can include any activity to cope with stressful situations: movement, conscious breathing, meditation, positive self-talk, body scans, and engaging in creativity. Self-regulation begins to develop during infancy, peaks during childhood and adolescence, and continues into adulthood; teaching children various strategies to self-regulate will form beneficial habits that are critical to functioning in society. Self-regulation is learned through the environment - one of the strongest factors being the adults present to mirror reactions and behaviors. However, when surrounded by conflict and unstable living situations, the potential to facilitate self-regulation mechanisms could be altered and possibly weakened. This study systematically reviewed 13 peer-reviewed studies that quantitatively examined the effects of intimate partner violence (IPV) exposure on self-regulation in children and adolescents. Studies were searched on four publicly available databases based on selected keywords. Inclusion criteria was based on study characteristics, theoretical frameworks, measurements of IPV and self-regulation, mediation and/or moderation effects, and numerical results of associations found. 11 studies identified significant negative effects of IPV exposure on aspects of self-regulation, and 2 studies identified indirect pathways through parenting and maternal depression. This study also reviewed and summarized the theoretical frameworks that captured the relationship between IPV exposure and children’s self-regulation.
Abstract:

Myosin XV is known to play many important roles in cells, one of which is protein delivery along filopodia towards the tips. Filopodia are small, actin-rich protrusions of the plasma membrane that serve as sensors of the cell’s microenvironment. Myosin XV is an actin-based motor protein that moves from the base of filopodia toward the tip. Our hypothesis is that one of the proteins transported by Myosin XV to the tips of filopodia is Delta. Delta is a transmembrane protein that activates Notch signaling in neighboring cells. If our hypothesis is correct, we should see Delta and Myosin XV colocalize in filopodia. To do this, we expressed a GFP-tagged Myosin XV in either bristles cells only or throughout the epithelium. We used a confocal microscope to visualize Myosin XV-GFP, Delta, and Actin in 12-hour-old pupal thorax tissue. Developing thorax epithelial cells have many filopodia on the basal surface of each cell. Myosin XV-GFP and Delta are visualized using a GFP and Delta antibody, respectively. We find that Myosin XV-GFP localizes to basal surface filopodia in the thorax. Delta was not found in the filopodia. That means Myosin XV does not transport the delta from the base of filopodia toward the tip.
Abstract:

Biosensors are commonly used due to their ease, inexpensive, and rapid testing results. Lactate is a common issue in diabetics that could lead to fatal results if not treated quickly, such as in the case of conditions of sepsis. Fabrication of this biosensor that could quantify lactate concentrations in sweat and produce a colorimetric response would be incredibly useful in the medical field and a tool for testing excess lactate.
Tuning Thermal Properties of Poly(Methacrylic Anhydride)-Based Copolymers

Cayden Fernandez

Abstract:

Polymers that undergo dynamic covalent exchange (DCE) can be reconfigured and reused eliminating the need for single-use polymers. One polymer that undergoes DCE is poly(methacrylic anhydride) (PMAA). Radical polymerization under semi-dilute conditions, methacrylic anhydride (MAA) yields linear PMAA chains with a high glass transition temperature (Tg ~135°C), which makes it inconvenient to thermally activate DCE. In order to be reprocessable for a wide range of applications, it is common for polymers to be made using multiple monomers to produce materials with a range of thermal and physical properties, including the ability to readily activate thermally-induced DCE. Therefore, by using different comonomers, such as butyl methacrylate (BMA), methyl methacrylate (MMA), and butyl acrylate (nBA), we expect to be able to tune the glass transition temperature of the resulting PMAA-based copolymers. Fourier transform infrared (FT-IR), 1H and techniques were used to show that the polymer copolymerized and provided information regarding the composition of the copolymers.

Cayden Fernandez, a rising sophomore, is a Chemical Engineering student from Carthage, New York. This summer he has been working on the production of a reusable thermoset polymer with the Shipp Research Group. He plans on pursuing a PhD in polymer science. He is an active member of the Clarkson ACS and plans on joining AlChE.
Computational Fluid Dynamic Analysis of a Cowled Wind Turbine

Auden Hope

Abstract:

Wind technology and specifically wind turbines constitute a significant part of the growth within the renewable energy field. Creating more efficient turbines whether onshore or off is the primary objective of many engineers within this field. This project is based on understanding the performance of a cowled wind turbine using Computational Fluid Dynamics (CFD) via ANSYS CFX and Fluent by creating a rotational domain around the turbine and simulating wind blowing across the blades of the turbine. The first phase of this project dealt with perfecting the creation of a rotational domain within ANSYS Fluent. This method was verified by testing a National Renewable Energy Laboratory (NREL) two-bladed turbine and a three-bladed turbine. The moment coefficients, the velocity of the wind across the blade and downstream from the turbine, and the pressure distribution across the blades were examined. These turbines were tested at 60 revolutions per minute with a wind speed of 5 meters per second. Upon carrying out initial simulations the three-bladed turbine simulation ran which produced a pressure distribution of the wind across the blade as well as successfully modeling the velocity of the airflow across the blades and further downstream. The two-bladed simulations produced errors at this point of the study. Using a default mesh size of 6 meters and running the simulation on the three-bladed turbine for 5000 iterations, the moment coefficient trended towards -0.1. This result is accurate as the blades of this turbine are flat and thin therefore a low moment coefficient was expected. The face of the blades of the turbine also showed a higher pressure region, 19.97 Pa, in comparison to the back, -46.22 Pa. The main focus for the future is to conduct a parameter study. This will include altering the downstream distance of the wake, and the number of elements within the mesh. A perfect rotational domain will also be created. This will be achieved when the angular velocity is not inputted into ANSYS as the angular velocity of the turbine will be determined based on the aerodynamic features of the entire turbine.
Organization of the Zebrafish Intestinal Stem Cell Compartment

Tenzin Kinzom

Abstract:

The base of the adult intestine folds contain stem cell niches. Within these niches, stem cells proliferate. Stem cell progeny differentiate into a mix of enterocytes and secretory cells as they move up the fold and apoptosis at the top of the fold. However less is known about the organization of the zebrafish stem cell compartment. Within mammals stem cells are at the crypt base interdigitated by Paneth cells. Progeny of stem cells move up to the transient amplifying zone where cells begin differentiating into enterocytes and secretory cells. We suggest that there may be a similar organization at the zebrafish fold base. Researchers have recently performed single cell sequencing of the six day post fertilization intestine and identified two progenitor cells (progenitor-like 1 (P1) cells, and progenitor-like 2 (P2)). We are interested in using markers of these cell types to identify the physical organization of these cells in the stem cell niche. We have cloned portions of the top differentially expressed genes for P1 and P2 for use in RNA in situ hybridization. P1 or P2 may be the stem cell while the other may represent a transient amplifying population. Organization of P1 and P2 within the intestine will begin to understand the organization.
Virtual (manual) Reconstruction of Fragmented Pig Humeri using 3D Scanning and MeshLab

Skylar Schmidt

Abstract:

The shift to computer technologies to assist in forensic reconstruction has been limited. Physical-fit analysis is time-consuming, can impact fragile evidence by increased handling time, and relies on the experience and dexterity of the analyst. This pilot study works to evaluate a process of virtual (manual) reconstruction of fragmentary bones with the goal of identifying bony features most useful for future training of artificial intelligence. Participants in this study varied by experience, with some having experience with 3D reconstruction, osteology, or both. Bone fragments consisted of sawed pig humeri, excluding the most proximal and distal end pieces. MeshLab was used for the reconstruction of the 3D scanned fragments and five variables were ranked and rated by each individual for helpfulness in reconstruction. These included specimen size, cross-sectional geometry, muscle markings, bone color/staining, and saw mark features (i.e., breakaway notch/spur). Individuals were also evaluated based on the correct order and orientation that they placed the fragments, and the time the reconstruction took was recorded. These methods were repeated by each individual using physical fit analysis as well. Experience, time, ratings/rankings, and correctness of both physical and virtual reconstruction were used to compare the ability of individuals to reconstruct the physical samples as well as the 3D scanned samples. The results of this study showed that cross-sectional geometry was more highly rated and ranked in both physical and virtual reconstruction for all individuals, while color was ranked and rated the least helpful in all categories. Individuals had 11 rotation errors and 9 upside-down fragments out of 20 total bone reconstructions with each reconstruction having six fragments. However, during the physical reconstruction where 16 total bone reconstructions were done, there were zero rotation errors and zero fragments that were upsidedown. A final evaluation showed that individuals were more likely to match correct faces closer to the distal end of the bone and showed more difficulty matching fragments that are in the shaft of the bone. This research is beneficial for forensic anthropology in moving towards the use of technological advancements within the field.

Skylar Schmidt is from Croghan, NY, and is currently a senior at Clarkson University majoring in Biology with a minor in Anthropology. This summer she has been working closely with Dr. Alicia Grosso to complete a research project relating to bone fragmentation in forensic science, and how individuals with different experience levels can reconstruct fragmented pig bones through computerized reconstruction of 3D scans. This research is beneficial in trying to progress forensics with technological advancements which can help for example, to decrease the amount of handling time of fragile evidence. She is considering pursuing a master’s degree in plant or soil sciences, or evolution, ecology, and behavior. Skylar enjoys gardening and taking care of house plants, and is involved in the Sustainability Club and Women’s Volleyball Club on campus.
Abstract:

Antibiotic resistance poses a dangerous and urgent global public health risk. As the number of multidrug-resistant pathogens continue to increase, it is imperative to find alternative treatments for these resistant bacterial infections. One potential alternative treatment is to use bacteriophage - phage or viruses that infect bacteria. Phage treatment has already shown success in some cases of difficult to treat multi-drug resistant bacteria, however the possibility of bacteria evolving resistance to the phage must be considered as well. In this project, we track the evolution of both antibiotic resistance and phage resistance in the bacteria Pseudomonas fluorescens Migula (PfM). The goal is to characterize how the evolution of antibiotic and phage resistance impact other bacterial traits such as growth rate and dispersal, and whether or not resistance to one treatment (either antibiotics or phage) impacts propensity for the bacteria to evolve resistance to the other. Previous theory and experiment work in other bacterial species suggests that there may be an evolutionary trade-off, whereby developing resistance to one treatment is contingent on restoring sensitivity to another.

Currently, replications of the evolution experiment suggest significant variability in the development of the same mutation. This indicates that the evolution course adopted by Pseudomonas fluorescens Migula may not be as predictable as originally thought, and treatment options for multi-drug resistant pathogens need to be assessed rigorously to ensure safety. Whole genome sequences of original mutants have already been extracted and will be useful in determining which genes are responsible for developing resistance and restoring sensitivity.
Abstract:

A limitation of the current dome slit at Clarkson University’s observatory is that it can only be operated manually from the observatory. An Arduino motor controller was designed to allow for manual operation with switches, and allow for remote control of the dome slit. The motor controller has been designed to interface with the Lesvedome software currently in use for the already automated dome rotation. The Arduino also incorporates some safety switches to ensure safe operation. The full automation when this project is done will allow for greater student access to the observatory, as it will allow for remote observing from campus.

Anthony Caraballo was born in York, Pennsylvania and grew up in Corona, Queens, one of the many populated Dominicans in the area. Corona was center of diversity, and Anthony’s culture was all of it, embracing each community and what it has to offer. Anthony attends Clarkson University as a physics major but added a major with Mathematics. This summer Anthony continued his research with Dr. Joshua Thomas from the semester before. Anthony is working in automating the dome’s slit since it only operates physically. Anthony is aiming pursuing a PhD in Astrophysics. Anthony does not have a particular dream school, but Massachusetts Institute of Technology would be cool to go to. Some of Anthony hobbies is playing video games, skateboard, and making kombucha.
Is there a Greater Presence of Parasites Found in *C. shinensis* in Slow Moving Freshwater?

*Rose Cotto*

Abstract:

The invasive Chinese Mystery Snail, also known as (*Cipangopaludina chinensis*), originated from Asia. It has now invaded North America and is disrupting the freshwater systems and the species that reside in them. We are researching the presence of micro fauna, parasites and commensal organisms, found inside *C. chinensis*. I hypothesized that there will be an overall greater presence of micro fauna in the snails from locations with slower moving water. We sampled 4 different locations, and collected a total of 150 Chinese Mystery Snails. To detect micro fauna, snails were kept overnight under a heat lamp and this process often expels internal micro fauna into the water if they are present. The water was examined under a microscope and samples were collected and preserved for later DNA analysis. We then dissected 5 samples from each location to inspect for parasites and other micro fauna.
Design and Fabrication of a Space Simulation Using a Small Cubesat Model with Embedded Sensors and a Robotic Arm.

Junior Tchapdieu

Abstract:

There are plenty of space missions involving the interaction between solid objects, such as the use of a robotic arm to remove space debris orbiting around Earth, or to connect multiple spaceship components together. Since those missions are very important, there is a need to test them before starting the mission in outer space. However, the behavior of objects in space is different than that of objects on Earth. Hence space emulation set up on the ground, such as air bearing tables, and hardware-in-the-loop simulations are used to test spacecraft before their launch. This research focuses on the development of a new kind of space emulation set up on the ground using a small box representing a satellite of cubic form, a robotic arm, a torque sensor, an inertial sensor, and force sensors. The box will be embedded with the force sensors, the torque sensor, and the inertial sensors, such that they can determine the force on, the torque on, and the displacement of the box. A control system that will use feedback from the sensors to track a displacement and interactions with the box will be developed. The control system will be implemented on the robotic arm which will serve as the tool that will displace the cubic box as it is interacting in space.

Junior Tchapdieu was born in Douala, Cameroun and majors in Aerospace engineering.

This summer, Junior has been working on the design of a system for space objects attitude simulation. Junior is working under the mentorship of Astrolab, which is a laboratory on campus directed by Professor Bazzocchi, with who he has been working one on one to complete his project.

Junior aspires to pursue a Master of Applied Science to continue his research journey and would specifically like to focus on the Attitude control of space objects. Junior would like to do his master’s at the University of Toronto in Canada. He likes to play soccer, which he tries to do every Saturday with people he has met on campus. He also enjoys playing the piano because it brings him some peace of mind.
<table>
<thead>
<tr>
<th>Scholar Name</th>
<th>UG University &amp; Year of Graduation</th>
<th>Graduate School &amp; Year of Graduation</th>
<th>Field of Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Derek Lucey</td>
<td>SUNY Potsdam 98’</td>
<td>U of Buffalo 02’</td>
<td>Inorganic Chemistry</td>
</tr>
<tr>
<td>Yasheka Nicholson</td>
<td>CU 00’</td>
<td>MT Sinai Med 04’</td>
<td>Medicine</td>
</tr>
<tr>
<td>Sean Speese</td>
<td>CU 98’</td>
<td>U of Utah 05’</td>
<td>Neuroscience</td>
</tr>
<tr>
<td>Shawn Clark</td>
<td>CU 98’</td>
<td>FSU’06</td>
<td>Biochemistry</td>
</tr>
<tr>
<td>Blaine Bettinger</td>
<td>SLU 98’</td>
<td>Upstate Med 06’</td>
<td>Biochemistry</td>
</tr>
<tr>
<td>Brittany Mitchell</td>
<td>CU 98’</td>
<td>U Michigan 07’</td>
<td>Atmospheric Science</td>
</tr>
<tr>
<td>April Krumnow</td>
<td>CU 02’</td>
<td>Auburn 07’</td>
<td>Biomedical Sciences</td>
</tr>
<tr>
<td>Michele Gauger</td>
<td>CU 01’</td>
<td>UNC Chapel Hill 07’</td>
<td>BioChem/Biophysics</td>
</tr>
<tr>
<td>Mose Herne</td>
<td>CU 97’</td>
<td>BU 09’</td>
<td>Public Health</td>
</tr>
<tr>
<td>Brad Beechler</td>
<td>CU 00’</td>
<td>Colorado Boulder 09’</td>
<td>Atmospheric Sciences</td>
</tr>
<tr>
<td>Matthew Benington</td>
<td>CU 04’</td>
<td>Notre Dame 09’</td>
<td>Aerospace Engineering</td>
</tr>
<tr>
<td>Damion Nero</td>
<td>CU 00’</td>
<td>NYU 09’</td>
<td>Bioinformatics</td>
</tr>
<tr>
<td>William Williams</td>
<td>CU 02’</td>
<td>U of Wisconsin-Mad 09’</td>
<td>Atomic Physics</td>
</tr>
<tr>
<td>James Nesteroff</td>
<td>CU 02’</td>
<td>Stonybrook 09’</td>
<td>Physics</td>
</tr>
<tr>
<td>Patricia Deshanie</td>
<td>CU 02’</td>
<td>CU 10’</td>
<td>Engineering Sciences</td>
</tr>
<tr>
<td>Todd Deshanie</td>
<td>CU 03’</td>
<td>CU 10’</td>
<td>Engineering Science</td>
</tr>
<tr>
<td>Danielle Bonsquet</td>
<td>CU 04’</td>
<td>Colorado Boulder</td>
<td>Research Methodology</td>
</tr>
<tr>
<td>Timothy Deschenes</td>
<td>CU 06’</td>
<td>U of Michigan 11’</td>
<td>Aerospace Engineering</td>
</tr>
<tr>
<td>John Garland</td>
<td>CU 00’</td>
<td>CU 11’</td>
<td>Physics</td>
</tr>
<tr>
<td>Samuel Emery</td>
<td>CU 04’</td>
<td>U Conn 11’</td>
<td>Physics</td>
</tr>
<tr>
<td>Tera Filion</td>
<td>CU 05’</td>
<td>U Mass Dartmouth 11’</td>
<td>Biomedical/Cell Biology</td>
</tr>
<tr>
<td>Michael Brazell</td>
<td>CU 06’</td>
<td>CU 12’</td>
<td>Mechanical Engineering</td>
</tr>
<tr>
<td>Dan Rissacher</td>
<td>CU 02’</td>
<td>CU 12’</td>
<td>Computer Engineering</td>
</tr>
<tr>
<td>Alberto Roman</td>
<td>CU 06’</td>
<td>CU 13’</td>
<td>Mechanical Engineering</td>
</tr>
<tr>
<td>Stefanie Kring</td>
<td>CU 08’</td>
<td>CU 14’</td>
<td>Env Science &amp; Eng</td>
</tr>
<tr>
<td>Scott Lalonde</td>
<td>CU 08’</td>
<td>Dartmouth 14’</td>
<td>Math</td>
</tr>
<tr>
<td>Dean Mastropietro</td>
<td>CU 08’</td>
<td>Virginia Tech 14’</td>
<td>Chemical Engineering</td>
</tr>
<tr>
<td>Ashley Macner</td>
<td>CU 07’</td>
<td>Cornell 14’</td>
<td>Chemical Engineering</td>
</tr>
<tr>
<td>Emmanuel Asare</td>
<td>CU 09’</td>
<td>Stony Brook 15’</td>
<td>Genetics</td>
</tr>
<tr>
<td>Maria (Lang) Choi</td>
<td>CU 11’</td>
<td>U of Michigan 16’</td>
<td>Aerospace Engineering</td>
</tr>
<tr>
<td>Nicole Conroy</td>
<td>CU 09’</td>
<td>Syracuse University 16</td>
<td>Child and Family</td>
</tr>
<tr>
<td>Caitlin (Minc) Grzeskiwia</td>
<td>CU12’</td>
<td>Baylor College Medicine 17’</td>
<td>Molecular Human Genetics</td>
</tr>
<tr>
<td>Scholar Name</td>
<td>UG University &amp; Year of Graduation</td>
<td>Graduate School &amp; Year of Graduation</td>
<td>Field of Study</td>
</tr>
<tr>
<td>--------------------</td>
<td>-----------------------------------</td>
<td>--------------------------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>Allen Osaheni</td>
<td>CU13’</td>
<td>Syracuse University</td>
<td>Mechanical Engineering</td>
</tr>
<tr>
<td>Yu Ling Huang</td>
<td>CU11’</td>
<td>Cornell University</td>
<td>Biological Engineering</td>
</tr>
<tr>
<td>Pinguang Yang</td>
<td>CU14’</td>
<td>Hofstra University</td>
<td>MD/PhD</td>
</tr>
<tr>
<td>David Yambay</td>
<td>CU11’</td>
<td>Clarkson University</td>
<td>Physics</td>
</tr>
<tr>
<td>Kyle Ventura</td>
<td>CU16’</td>
<td>University of Florida</td>
<td>Materials</td>
</tr>
<tr>
<td>Andrew Bluestein</td>
<td>CU13’</td>
<td>Clarkson University</td>
<td>Mechanical Engineering</td>
</tr>
<tr>
<td>Jeff Smith</td>
<td>CU15’</td>
<td>Notre Dame</td>
<td>Electrical Engineering</td>
</tr>
<tr>
<td>Ravon Venters</td>
<td>CU11’</td>
<td>Clarkson University</td>
<td>Mechanical Engineering</td>
</tr>
<tr>
<td>Zachary Rodriguez</td>
<td>CU14’</td>
<td>Louisiana State University</td>
<td>Biological Sciences</td>
</tr>
<tr>
<td>Emmalynn Dupree</td>
<td>CU16’</td>
<td>Clarkson University</td>
<td>Chemistry</td>
</tr>
</tbody>
</table>