

COLLEGE OF THE
Holy Cross

**Twenty-Ninth
Annual Symposium**

**Dr. Charles S. Weiss
Summer Research Program**

**September 8, 2023
Hogan Ballroom**

Dear Members of the Holy Cross Community,

Welcome to the 2023 Dr. Charles S. Weiss Summer Research Symposium. Now in its 29th year, the symposium is a college-wide event, bringing together faculty and students from all disciplines at Holy Cross and providing an opportunity to celebrate their accomplishments over the summer of 2023. It also affords an occasion for students to witness the breadth of research possibilities both on and off campus, and to open a dialogue with members of the faculty about conducting research during the upcoming academic year and summer.

The program and symposium are named after Charles “Chick” Weiss who joined the psychology faculty in 1975 with a Ph.D. in neurobiology and physiology from Ohio University. An esteemed professor, mentor and scholar, Weiss served as the chair of the psychology department from 1984 to 1989. He also served the College as Coordinator of Grants and Research (1989-95), the Director of the Office of Grants and Corporate and Foundation Giving (1995-2003), and the Director of Strategic Initiatives and Corporate and Foundation Relations from 2003 until his retirement in 2016. Weiss was integral to bringing major projects to life, most notably the College’s Integrated Science Complex, Brooks Concert Hall and the Summer Research Program.

We hope you enjoy the impressive collection of scholarship on display today.

Daniel Bitran, College Science Coordinator, Director Summer Research in Natural Sciences and Mathematics

Anthony Cashman, Director Summer Research in Humanities, Social Sciences, and Arts

Daniel Tortorice, Director Summer Research in Economics

In recognition of those whose financial contributions have made this research possible:

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- 93. Equitable Care and Equal Access: Are There Specific Factors Affecting Door to Balloon Time?** G. DiRaimo, J. Hernandez, S. Sokol, E. Gashi-Baraliu, and C. Marini. *Departments of Surgery and Cardiology, Jacobi Medical Center*
- 94. “Reimagining the Summer School Model”: The Goals of Summer Programming Post-COVID-19.** A. Economou and L. Capotosto. *Department of Education, College of the Holy Cross*
- 95. Detecting Atmospheric Muons Using Muon Telescopes.** M. Lawrence, L. Ivanoski, B. Alvarez, and T. Narita. *Department of Physics, College of the Holy Cross*
- 96. The Implementation of Muon Telescopes.** L. Ivanoski, M. Lawrence, B. Alvarez, and T. Narita. *Department of Physics, College of the Holy Cross*

97. The Cyclic Nature of Atmospheric Muons. *B. Alvarez, M. Lawrence, L. Ivanoski, and T. Narita. Department of Physics, College of the Holy Cross*

The following posters can be found in front of the stage – displays will accompany the poster presentations.

S01. Working on the Publication of the Spanish Theater Journal: Estreno: Cuadernos del teatro español contemporáneo. *A. Del Cid and H. Freear-Papio. Department of Spanish, The College of the Holy Cross*

S02. Cinegogía and Cineglos: Digital Humanities and Latin American Film. *É. Bailey, A. Collazo and B. Franco, Department of Spanish, College of the Holy Cross*

S03. Medieval Silks Across Cultures: Examining Iconographies in Textiles Related to Latin Translations Found in English Collections. *Y. Ren, K. Phan, and A. Luyster. Department of Visual Art History, College of the Holy Cross*

S04. Dispatches from the Future: Documenting New England Apples in a Wilding Climate. *R. Comcowich, M. Rigione, and D. C. Harvey. Department of Sociology and Anthropology, College of the Holy Cross*

S05. Hyperbolic Voronoi Diagrams of Horocycles. *D. Sefransky and R. Winarski. Department of Mathematics and Computer Science, College of the Holy Cross*

S06. On Your Own: Maintaining Creative Motivation Post Graduation. *A. B. Raper and L. Schomp. Department of Studio Art, College of the Holy Cross*

Poster 1

Complete permutation polynomials from reversed Dickson polynomials and their applications in Cryptography

J. Fang and N. Fernando

Department of Mathematics and Computer Science

College of the Holy Cross

Let p be a prime number. Then the finite prime field with characteristic p is given by $Z_p = \{0, 1, 2, \dots, p-1\}$. A permutation polynomial over Z_p is a polynomial that permutes the elements of Z_p . For example, consider the polynomial $g(x) = 5x + 1$ and evaluate it at each element of Z_7 . Then, in characteristic 7, we have $g(0) = 1, g(1) = 6, g(2) = 4, g(3) = 2, g(4) = 0, g(5) = 5, g(6) = 3$. Since $g(x)$ permutes the elements of Z_7 , $g(x)$ is a permutation polynomial of Z_7 . A polynomial is called a complete permutation polynomial if both $f(x)$ and $f(x) + x$ are permutation polynomials. Consider the polynomial $h(x) = g(x) + x = 6x + 1$ and evaluate it at each element of Z_7 . Then, in characteristic 7, we have $h(0) = 1, h(1) = 0, h(2) = 6, h(3) = 5, h(4) = 4, h(5) = 3, h(6) = 2$. Since both $g(x)$ and $g(x) + x$ permute the elements of Z_7 , $g(x)$ is a complete permutation polynomial of Z_7 . Reversed Dickson polynomials are defined by the recurrence relation $D_0(1, x) = 2, D_1(1, x) = 1$, and $D_n(1, x) = D_{n-1}(1, x) - xD_{n-2}(1, x)$ for $n \geq 2$. Here are the next few reversed Dickson polynomials:

- $D_2(1, x) = 1 - 2x$
- $D_3(1, x) = D_2(1, x) - xD_1(1, x) = (1 - 2x) - x = 1 - 3x$
- $D_4(1, x) = D_3(1, x) - xD_2(1, x) = 1 - 16x + 2x^2$
- $D_5(1, x) = D_4(1, x) - xD_3(1, x) = 1 - 125x + 5x^2$

We present complete permutation polynomials arising from reversed Dickson polynomials over Z_p . Moreover, we explain an application of complete permutation polynomials in Cryptography.

We thank the Dr. and Mrs. Anthony M. Marlon '63 Summer Research Fellowship and the Robert J. Stransky Foundation Research Fellowships in the Sciences for financial support.

Poster 2

Reversed Dickson Polynomials over finite fields

H. Wu and N. Fernando

Department of Mathematics and Computer Science

College of the Holy Cross

Let p be a prime number and Z_p denote the finite field with p elements, that is, $Z_p = \{0, 1, 2, \dots, p - 1\}$. A polynomial $f \in Z_p[x]$ is called a permutation polynomial of Z_p if it permutes the elements of Z_p . For example, consider $g(x) = x^3 + 1$, and evaluate it at each element of Z_5 . Then, in characteristic 5, we have $g(0) = 1$, $g(1) = 2$, $g(2) = 4$, $g(3) = 3$, $g(4) = 0$. Since the polynomial $g(x)$ permutes the elements of Z_5 , $g(x)$ is a permutation polynomial in Z_5 . As you can see in the previous example, the polynomial $g(x)$ maps 3 to itself. We call such a point a fixed point. In previous example, we have $0 \rightarrow 1$, $1 \rightarrow 2$, $2 \rightarrow 4$, $4 \rightarrow 0$. This is a four-cycle which can be written as $(0\ 1\ 2\ 4)$. Thus, the cycle type of the permutation induced by $g(x)$ over Z_5 is $(4,1)$, where 4 stands for the four-cycle and 1 stands for the fixed point. Reversed Dickson polynomials are defined by the recurrence relation $D_0(1, x) = 2$, $D_1(1, x) = 1$, $D_n(1, x) = D_{n-1}(1, x) - xD_{n-2}(1, x)$, for $n \geq 2$. Here are the next few reversed Dickson polynomials:

- $D_2(1, x) = 1 - 2x$
- $D_3(1, x) = D_2(1, x) - xD_1(1, x) = (1 - 2x) - x = 1 - 3x$
- $D_4(1, x) = D_3(1, x) - xD_2(1, x) = 1 - 16x + 2x^2$
- $D_5(1, x) = D_4(1, x) - xD_3(1, x) = 1 - 125x + 5x^2$

We explain the fixed points and cycle types of permutation polynomials arising from reversed Dickson polynomials over Z_p .

We thank the Weiss Summer Research Program for financial support.

Poster 3

Numerical Models of Rotating Neutron Stars and Their Interactions with Dark Matter

J. Cronin and B. Kain

Department of Physics, College of the Holy Cross

Neutron stars are among the densest objects in the universe. They pack about 1.5 solar masses inside a volume about one quintillionth ($1/1,000,000,000,000,000,000$) of the volume of our sun, forming when a massive star runs out of fuel and collapses. Our research focused on modeling these neutron stars using code in the programming language Python. After writing code to model a non-rotating neutron star, we moved to modeling a rotating neutron star. To model these rotating neutron stars, we used the slow rotation approximation. This approximation greatly simplifies our equations, making our program a lot easier to write and a lot quicker to run than if we did not use the approximation. Also, most observed neutron stars rotate at speeds well within the approximation, so our results will be very useful. There were two main models of rotating neutron stars that we focused on: a neutron star being made up of one fluid, and a neutron star being made up of two fluids. The single-fluid model was our way of modeling a neutron star made up entirely of ordinary matter. In addition, we wanted to come up with a way to model dark matter interacting with the neutron star. We do not know much about dark matter or what it even is, so we believed that given the neutron star's high density and other unique properties, modeling dark matter interactions with the neutron star might give us some insight into the properties and nature of dark matter. This is where the two-fluid model comes in. One fluid models ordinary matter, while the other models dark matter. Using this model, we hoped to see how the properties of the star changed with the addition of dark matter. We also were curious to see what properties of the star, if any, would be unaffected by the introduction of dark matter.

We thank the George I. Alden Trust Excellence in Career Related Undergraduate Education for financial support.

Poster 4

Solving Rotating Dark Matter Admixed Neutron Stars: Moment of Inertia, Tidal Love Number, and Quadrupole Moment

X. Zhang and B. Kain

Department of Physics, College of the Holy Cross

The neutron star is among the densest objects in the universe. Matter in it can be described using the perfect-fluid description, which has equations of state that relate ϵ , the energy density, and p , the pressure of the star. Since neutron stars are so dense, dark matter may be caught in them, forming dark matter admixed neutron stars. In this study, we assume that dark matter is a fermion, which can also be described with the fluid model. To solve for rotating dark matter admixed neutron stars, we wrote code that could numerically solve differential equations that describe the neutron star. We used the slow rotation approximation for the stars' rotation and a two-fluid model, which had one fluid for ordinary matter and the other for dark matter, each with a different equation of state. From our solution, we computed three quantities: I , the star's moment of inertia, λ , the tidal Love number, which described the deformation of neutron stars when spiraling toward each other, and Q , the quadrupole moment, which described the deformation of the star while it rotates. These three quantities could be used to calculate \bar{I} , $\bar{\lambda}$, and \bar{Q} , and in single-fluid neutron stars, the plots of these quantities were independent of the equation of state and had fit lines. We calculated these quantities for two-fluid neutron stars, and our plots align with the fit lines for single-fluid neutron stars.

We thank the Weiss Summer Research Program for financial support.

Poster 5

Model for Temporomandibular Joint Osteoarthritis (TMJ-OA)

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¹Department of Orthodontics, University of Nebraska, Omaha, NB;

²Departments of Orthodontics, Biomedical Engineering, Orthopedic Surgery and Cell Biology, UConn Health, Farmington, CT.

Over 32.5 million US adults suffer from osteoarthritis (OA), a disease characterized by degeneration and loss of the cartilage of the joints, including the Temporomandibular Joint (TMJ). There is no cure for OA making this an important unmet clinical need. Previously, we found that genetic activation of the Epidermal Growth Factor Receptor (EGFR) pathway in mice stimulated growth responses in the Mandibular Condylar Cartilage (MCC) of the TMJ. Further, we found that treatment with an EGFR factor stimulated matrix deposition by human articular cartilage (AC) in an *in vitro* system. We hypothesize that EGFR factor might one day be clinically useful for treatment of cartilage degeneration and loss in TMJ-OA. The goal of this project is to develop a clinically relevant *in vitro* model of TMJ-OA in which to test this hypothesis. MCC tissue was extracted from healthy, adult pig jaws. Fresh tissue was immediately fixed, then embedded, sectioned, and stained with Safranin-O, and examined microscopically to evaluate tissue integrity. Some tissue was maintained *in vitro* for 6 or 9 days in the absence or presence of Interleukin-1-Beta (IL1-B), an agent that causes cartilage damage. Fresh pig MCC tissue shared general morphologic features of human MCC. However, pig MCC was less similar to mouse MCC and to human AC. Pig MCC tissue may offer a morphologically similar substitute for human MCC tissue, which is difficult to obtain for experiments. Further research will be needed to validate IL-1B induced cartilage damage in pig MCC *in vitro*.

The authors acknowledge the support of the Department of Health Career Opportunity Programs, Aetna Health Professions Partnership Initiative, and research funding from AOSSM 20200508.

Poster 6

Connecting Mythological Figures and Events in Medieval Homeric Manuscripts and Apollodorus' *Library*

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Department of Classics, College of the Holy Cross

Our research relates mythological traditions in an 11th-century manuscript of the *Iliad* (British Library, Burney 86) to the *Library* of Apollodorus, a mythological handbook from the second century CE. The Burney 86 is especially notable for its thousands of marginal notes, or *scholia*, commenting on the text of the *Iliad*. These notes cover a broad range of topics, including background stories that help the reader understand the characters and events of the *Iliad*. While the *scholia* and the *Library* are both rich sources for studying Greek mythology, their texts have not previously been systematically connected. We focused on creating digital editions to explore the texts together by identifying common *characters* and *actions*. We chose book 6 of the *Iliad* as a test case, and began by editing the *Iliad* text itself along with the *scholia* to book 6. The goal of editing the text of the Burney 86 was to ensure that every mark on the page made by the original scribe would be encoded in a digital format. By editing the Burney 86, we created a digital version of the text that could be compared to an already existing digital edition of the *Library*. For our work comparing the two texts, we started by using standard markup techniques in our edition of the Burney 86 to identify individuals with unambiguous identifiers. We applied the same identifiers to names in an English translation of Apollodorus so that we could align English and Greek passages where individuals appear. We next began identifying verbs - the action words of each sentence - to see what kinds of activity characters are associated with. From the comparisons that we were able to make between the *scholia* and the *Library*, we saw that the *Library* focused on summaries of myths and genealogies of mythical figures, while the *scholia* explained details of myths to help the reader understand the *Iliad*.

We thank Deborah C. and Timothy W. Diggins '80, and the Weiss Summer Research Program for financial support.

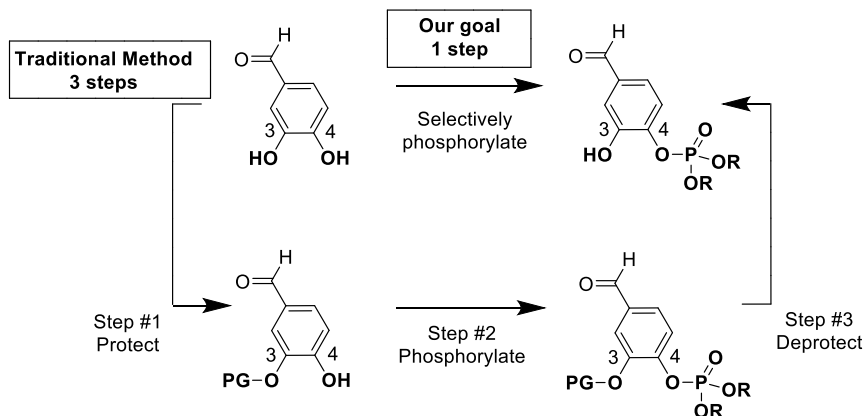
Poster 7

Site-Selective Phosphorylation of 3,4-dihydroxybenzaldehyde: A More Efficient Step in the Synthesis of Foslevodopa

W. Reller and B. Sculimbrene

Department of Chemistry, College of the Holy Cross

Foslevodopa is a well-tolerated drug used in the treatment of advanced Parkinson's Disease. A common synthetic route used to produce it begins with 3,4-dihydroxybenzaldehyde, which contains two reactive hydroxyl groups (denoted as positions 3 and 4 in the figure), and involves a phosphoryl transfer to just the 4 position. Traditionally, to target the 4 position exclusively the 3 position must be prevented from reacting via the use of a protecting group (PG) prior to the phosphoryl transfer and then deprotected after the synthesis is completed. A more efficient method would be to deliver the phosphate selectively to the 4 position without targeting the 3 position. Our group investigates the possibility that this can be done by using a catalyst to alter the natural reactivity of the compound and promote a selective reaction. In addition to a catalyst, we seek to improve this process by optimizing other variables, such as the solvent, base, phosphorylating agent, and ratios of reagents. Our endeavors have been aided by the discovery that we can use NMR to assess the efficacy of various catalysts quickly and accurately, which has greatly increased the rate at which we can test different conditions.



We thank the George I. Alden Trust for Excellence in Career Related Undergraduate Research for financial support.

Poster 8

A Minimal Higgs Portal Dark Matter Model Under Current Experimental Constraints

A. Clark and S. Chakdar

Department of Physics, College of the Holy Cross

Dark matter (DM) constitutes approximately 26.8% of the energy density in our universe, and the only concrete evidence we have for its existence is its effects on matter that we can sense. Some prudent examples include galaxy rotation curves and the cosmic microwave background. In galaxy rotation curves, there is an excess of mass that keeps the velocity constant; this mass cannot be seen or touched. The CMB emits light throughout our universe, which happens to be bent. These two examples demonstrate that although DM cannot be seen, its effects are felt throughout the universe. Scientists have postulated different theories for DM, but one of the best candidates are weakly interacting massive particles (WIMPs). WIMPs are non-baryonic and electromagnetically neutral, with masses in the GeV to TeV range, and they are detected using nuclear recoil. Researchers know of their existence by witnessing nuclei shake after interacting with a WIMP. The Higgs portal DM model falls under the umbrella of WIMPs. This model opens a portal between DM and the Standard Model (SM). Essentially, the DM particles interact with the 125 GeV Higgs, which then decays into SM particles. However, there is also an invisible portion of the Higgs decay, which may be connected to DM. In this study, we utilized a minimal Higgs portal DM model, meaning the DM candidates interact with only one 125 GeV Higgs, as opposed to multiple. This model adds a Z_2 -odd scalar field, which ensures that the DM candidates are stable and will not decay. Our goal is to analyze the connection between the branching ratio of the invisible decay of the Higgs to the mass of the DM candidates and the connection between the abundance of the DM candidates and their masses.

We thank Mary Ellen and James C. Hebert, M.D. '73 for financial support.

Poster 9

Synthesis of Indolizines Via CuAAC and Rhodium Catalysis

A. Thepsomphone and A. K. Isaacs

Department of Chemistry, College of the Holy Cross

Indolizine, one of the five isomers of indole, is a heterocyclic compound commonly used in medicines with antifungal, anticancer, anti-inflammatory, and antibacterial properties. Our research group has developed a method to efficiently synthesize indolizines from a terminal alkyne to a 1,4-disubstituted 1,2,3-triazole in good yields. 2-pyridine acetonitrile undergoes propargylation to generate the terminal alkyne by employing "click chemistry" which utilizes a copper(I) catalyst. The 1,4-disubstituted 1,2,3-triazole product can be subsequently decomposed to the rhodium carbenoid after addition of a rhodium(II) catalyst. Our work has been focused on optimizing this last step to produce the indolizine in greater yields. Variables such as temperature, running the reaction under different gasses, and incorporating different additives to prevent the pyridine from coordinating with the rhodium catalyst were probed. Future work will entail the continued optimization and eventually substrate scope expansion.

We thank the National Science Foundation funded Center for Computer Assisted Synthesis (C-CAS) for financial support.

Poster 10

Protein Interactions in a Toxin Translocation Mechanism through the Bacterial Outer Membrane

G. Beal, H. Murphy, and C. Hagan

Department of Chemistry, College of the Holy Cross

Bacteria produce many different types of toxic molecules to kill other competing microorganisms in their environment. Contact-dependent inhibition (CDI) systems are one example of these interbacterial competition mechanisms. The *E. coli* bacteria that we study contain these CDI systems and produce a cell surface protein named CdiA that binds to a specific receptor protein on the surface of a neighboring cell. The CdiA protein then injects a toxin protein into the neighboring cell, killing it. Once this process is better understood, the mechanism could be helpful in identifying ways of transporting antibiotics across the outer membranes of bacteria that are resistant to current treatments. We have studied how CdiA interacts with its receptor using photocrosslinking and cysteine crosslinking. These experiments allow us to understand the orientation and proximity of different regions of the two proteins to one another. We have specifically been probing interactions of CdiA with the lateral gate of the receptor protein; that gate normally functions in the assembly of proteins into the outer membrane, so it could potentially aid in the assembly of CdiA into the target cell membrane. Our results suggest that CdiA is positioned near this gate, but it is not yet clear whether the gate assists in the folding of CdiA and delivery of the toxin.

We thank Diane D. Brink P12, Wendy R. and Kenneth J. Edwards, M.D. '80 P12, Karen and Gerald P. Migliaccio '77, and Kim and Wendell P. Weeks P15 for financial support.

Poster 11

Investigating the Toxin Release Mechanism of a Bacterial Inhibition Protein

G. Conroy, A. K. Tiu, and C. L. Hagan

Department of Chemistry, College of the Holy Cross

Contact-dependent inhibition (CDI) is a mechanism through which Gram-negative bacteria transport toxins into neighboring, competing cells in their environments. The critical component of CDI systems is a large protein called CdiA, which contains a toxin domain at its C-terminal end. When CdiA binds to its receptor protein, BamA, in the outer membrane of a neighboring cell, the toxin domain is delivered across the target cell's membrane and released. Little is known about the toxin release mechanism itself. We have developed an assay to monitor the release of the toxin domain from a purified fragment of CdiA. Our experiments establish that the release occurs through a self-catalyzed proteolytic event. We have identified several critical amino acids involved in the cleavage mechanism, as well as factors that affect the efficiency of cleavage. By understanding how this mechanism is coupled to the folding of the CdiA protein and transport of the toxin across the target membrane, we hope to identify new approaches to killing Gram-negative bacteria—particularly those that are resistant to antibiotics.

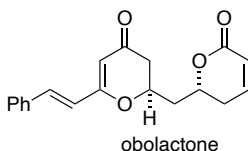
We thank Wendy R. and Kenneth J. Edwards, M.D. '80 P12, and the Anthony Marfuggi Summer Research Endowment for their generous financial support that made our project a reality.

Poster 12

Synthesis of Dihydro- γ -pyrones via Sequential C-O and C-C Bond Oxidation of Tetrahydropyranols

P. A. Drury, C. L. Sullivan, and K. J. Quinn

Department of Chemistry, College of the Holy Cross



Dihydro- γ -pyrones, oxygen-containing heterocycles containing an α - β unsaturated ketone, are present in many natural products that have important biological and chemical functions. Obolactone is one such natural product; it is isolated from *Cryptocarya obovata*, a tree native to Australia. Obolactone exhibits anticancer activity on the KB cell line and is active against the bacteria that causes African sleeping sickness. We have developed an efficient approach to the dihydro- γ -pyrone substructure by sequential C-O and C-C bond oxidation of readily accessible tetrahydropyranols. Our approach relies on the use of two different oxidizing agents, the Dess-Martin periodinane and DDQ, to perform the two oxidation steps. We will discuss the preparation of an appropriate model system, our optimization of the reaction conditions for the C-C bond oxidation and the successful one-pot procedure we have developed. Our future plans include a continued study of the optimization of the reaction, including a complete screen of single oxidant systems. Application of this method to the natural product cryptoconcatone H, which was previously prepared in our lab, will provide obolactone in just four steps, the shortest synthesis reported to date.

We thank the John Flavan '53 Bequest and the Camille and Henry Dreyfus Foundation for financial support.

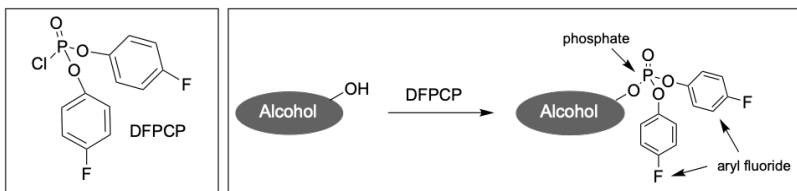
Poster 13

Phosphorylation of Alcohols using DFPCP, a Novel Phosphorylating Agent

A. Ihlefeld and B. Sculimbrene

Department of Chemistry, College of the Holy Cross

Phosphates and aryl fluorides have been prevalent groups in many of the drugs approved by the FDA in recent years. Phosphates are important for the bioavailability and activation of drugs. Aryl fluorides play a significant role in slowing the body's ability to metabolize a drug, allowing for fewer doses and longer lasting effects. Pharmaceutical compounds of these structures have been used to treat a wide range of diseases, such as cancers, Alzheimer's, and arthritis, among others. Our goal has been to create a novel phosphorylating agent which delivers the phosphate and aryl fluoride in a single step to a variety of alcohol substrates to yield products similar to those used in the pharmaceutical industry. This summer, I worked on optimizing the production of our phosphorylating agent, DFPCP, encouraging the reaction to favor our product (varying the reagent equivalents, heating time, etc.) as well as examining distillation conditions that best isolate the DFPCP from other byproducts. Using this reagent, we worked on the phosphorylation of alcohols containing more complex functional groups, which required that we experiment with the conditions (solvent system, heat, reaction time, etc.) to optimize the reaction. All new compounds were characterized using ^1H , ^{13}C , ^{19}F , and ^{31}P NMR.



We thank the Camille and Henry Dreyfus Foundation for financial support.

Poster 14

Copper-Catalyzed Approach to 4-alkylidene β - lactams

R. De Leon and A. K. Isaacs

Department of Chemistry, College of the Holy Cross

The primary purpose of our research is to create 4-alkylidene β -lactams through the use of “click chemistry”. β -lactams are important due to their structural abundance in many antibiotics, such as penicillin. Click chemistry is the copper-catalyzed azide-alkyne cycloaddition reaction that generates a 1,2,3-triazole which can spontaneously decompose to a reactive ketenimine intermediate with the use of tosyl azide. Application of this chemistry to our designed dialkyne substrate affords a 4-membered heterocyclic β -lactam precursor. This precursor leads our research one step closer to accessing a β -lactam. One distinguishing feature of our current method when compared to past known methods is the facile installation of the exocyclic double bond that is characteristic of the 4-alkylidene β -lactam. Currently, through our proposed pathway, we have been able to create 16 distinct 4-alkylidene β -lactam precursors in moderate to good yields. Our future research involves the development of an analogous pathway to the desired β -lactam.

I would like to thank the National Science Foundation funded Center for Computer-Assisted Synthesis (C-CAS) for sponsoring this research.

Poster 15

An Interpretation of the Solow Growth Model with Persistence Diagram

D. Z. Zhu and D. Damiano

*Department of Mathematics and Computer Science
College of the Holy Cross*

The purpose of this project is to investigate whether a topological approach can be used to determine the optimal time delay for the Solow Growth Model. The Solow growth model is an economic model that tries to explain economic growth by accounting for the different reserves of labor and capital per person within the economy. The concept of time delay is important to consider labor in the economy cannot be applied immediately after its creation. As a result, not taking this factor into account may lead to the inaccuracy of the prediction of the model. This project applies persistent homology to investigate the effect of time on the shape of the limit cycle of the model. We use the maximum lifespan of a dimension one persistence point in response to the different time delay with the given set of parameters. The result of the project is that the largest lifespan of persistent point for each time delay spanning from 4 to units of time at its local maximum in a periodic behavior, which corresponds to the work of Carlo Bianca in “Existence of Limit Cycles in the Solow Model with Delayed-Logistic Population Growth.” Further works are necessary to investigate a larger span of time delay and to see whether the periodic behavior extends to the greater time delay.

We thank the Summer Research Fellowship in Mathematics and Physical Sciences for financial support.

Poster 16

Analyzing flow fields and discharge rates of granular materials flowing out of a tilted silo

L. Xiao and R. Kozlowski

Department of Physics, College of the Holy Cross

Granular materials are a collection of discrete, macroscopic solid particles, such as grains or sand, that interact with each other through frictional forces and collisions. These materials show behaviors similar to solids, liquids, or gasses under different conditions. Understanding granular flow is important in industries such as pharmaceuticals or agriculture. In this work, we explored a quasi-2D system in which grains are poured from a container (silo) that has an opening at the bottom (orifice) to measure the dependence of outpouring flow rate, packing density, and average velocities of grains on the silo's angle and the orifice's opening size. One objective of our work was to use microcontrollers to automate an LED panel and a camera for recording videos of grains in the silo. We then installed an accelerometer to the silo which accurately measures the silo's tilt angle, and we prepared a microcontroller script that can be used to control a stepper motor to automate rotation of the silo in a future experimental set-up. The other objective of the work was to collect and analyze data on the mass flow rate of exiting grains and the average velocity vector field of the grains throughout the silo. We focused on characterizing the effect of silo tilt angle on the size and shape of the accelerating zone, a limited region around the orifice where grains do not experience significant dissipation of kinetic energy. As the silo tilt angle increases, the area of the accelerating region decreases and the symmetrical shape at zero tilt angle skews toward the upper end of the tilted orifice while the size of the stagnant zone, a region of limited grain motion, increases near the bottom end of the tilted orifice.

We thank the Robert J. Stransky Foundation Research Fellowships in the Sciences. for financial support. We also thank Trevor Wallace from Tufts University for volunteering in the lab on this and other projects with Prof. Kozlowski.

Poster 17

Always Be Around: Corita Kent, Community and Pedagogy

N. Howard and R. Beaudoin

Department of Visual Arts, College of the Holy Cross

Always Be Around: Corita Kent, Community and Pedagogy is a contemporary art exhibition that celebrates the work and teachings of 20th-century American pop artist, educator, and social justice advocate, Corita Kent. Corita is well known for her text-based prints that contain vibrant colors and overarching messages relating to social justice. The exhibition will be displayed in the Cantor Art Gallery during the fall semester of the 2023-2024 academic year and is curated by Professor Rachelle Beaudoin in the Visual Arts Department. I assisted Professor Beaudoin with the curatorial process of assembling the exhibition, including writing wall labels for a variety of Corita's prints and accompanying her on art studio visits. Professor Beaudoin and I also visited the Schlesinger Library at Harvard University's Radcliffe Institute where we analyzed the *Papers of Corita*, a comprehensive archive of personal letters and documents relating to her life and work. My research focused on Corita's work as an art educator at Immaculate Heart College. My research paper analyzes Corita's unique teaching philosophy centered around the practices of close-looking and finding sources of inspiration through unconventional means. This paper concludes that Corita's innovative and pioneering work as a teacher had a profound impact on her own artistic endeavors as a pop artist and established her as an influential force in the field of art education. This project allowed me to explore the connections between art and political social movements. This project also introduced me to important curatorial decisions associated with the planning and execution of a contemporary art exhibition as well as provided me with essential opportunities regarding research and presentation.

We thank the Weiss Summer Research Fellowship in Humanities, Social Sciences, and Fine Arts for financial support.

Poster 18

(Un)Spicing the American Melting Pot: The Commodification of Cultural Appetites, Seduction of Tropicalization, and Reclamation of the Latina Body in the Literature of Magical Feminism

J. Kazlauskas and J. Santos

Department of English, College of the Holy Cross

Magical realism is a Latin American genre of literature characterized by the portrayal of fantastical events in an otherwise realistic framework, communicated through a linguistic aesthetic of sensual richness. Integral to the genre are themes of passion, mystery, and exoticism, all of which easily segue into the reduction of the Latina body to nothing more than a site for cultural consumption's gluttonous feast: a process defined under Aparicio and Chávez-Silverman's sociological theory of tropicalization. Although the hegemonic effects of tropicalization – the dominant subjectivity's appropriation of the marginal subjectivity's traits, images, and values – can appear in a variety of forms and visual texts, my research project particularly analyzes the ways in which tropicalized tropes of Latina sexuality are represented within the genre of magical realism, culturally consumed as ideological fictions in the United States, and then reclaimed by U.S. Latina authors. Magical feminism, coined by Patricia Hart, is a genre which employs magical realism to comment on the condition of women in a femino-centric work and my research considered three novels that fall under this literary categorization: Isabelle Allende's *The House of the Spirits*, Cristina García's *Dreaming in Cuban*, and Julia Alvarez's *How the García Girls Lost their Accents*, all of which address the intersectional topics of gender, colorism, and sexuality. By analyzing three women-authored texts of magical feminism, my research seeks to highlight the ways in which this genre undercuts the adverse effects of tropicalization and protects the nuanced nature of Latina iconicity through a written union of the magical and the real in America.

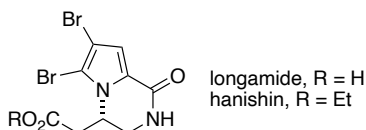
We thank the Weiss summer research program for financial support.

Poster 19

Development of Single-step Approaches for the Synthesis of β -Amino Carbonyl Compounds

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The β -amino carbonyl structural motif is common among biologically and chemically relevant natural products and pharmaceutical agents. The aim of our research is to investigate strategies for the synthesis of β -pyrrolo-esters and 1,3-amino alcohols from readily available pyrrole- and carbamate-substituted terminal alkenes. Both of our strategies rely on the use of a transition metal catalyst, which are critical for the advancement of new and efficient synthetic pathways. The first approach involves the use of a palladium-catalyzed carbonylative cyclization, in which Pd activation of the terminal alkene precedes nucleophilic attack by an appropriately positioned nucleophilic heteroatom. The second approach involves the use of an olefin cross metathesis, using a ruthenium catalyst, to activate the terminal alkene as an electrophile followed by intramolecular aza-Michael addition. We will discuss the preparation of substrates for these reactions and the results of the proposed cyclization steps. If successful, these studies would expand the scope of these important heterocycle-forming reactions and provide efficient and flexible access to several classes of naturally occurring compounds, including members of the longamide family, which display cytotoxic activity against a variety of human cancer cell lines.

Financial support from the Kim and Wendell P. Weeks P15 and the Organic Syntheses Summer Research Grant Program is gratefully acknowledged.

Poster 20

Tackling Severe Obesity in Neuro-Atypical Adolescents with Laparoscopic Sleeve Gastrectomy: Unique Challenges and Caregiver Perspectives

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Metabolic and bariatric surgery (MBS) is the most effective means of weight loss and leads to the resolution of many complications associated with severe obesity. In the United States, neuro-atypical adolescents are nearly twice as likely to have obesity than those who are neuro typical. The American Society for Metabolic and Bariatric Surgery states that cognitive disability should not be a reason to deny surgical treatment in adolescents with severe obesity. However, data on the outcomes of MBS in neuro-atypical individuals and unique aspects of care are sparse. As a result, we conducted a case series of three neuro-atypical adolescents with severe obesity who underwent sleeve gastrectomy (SG), the most common form of MBS, and examined the roles and perspectives of multiple healthcare disciplines that contributed to the success of SG in these adolescents. A systematic history, clinical findings, pre- and post-operative progress in weight loss were obtained from medical records. Patients received treatment at a weight center encompassing care from pediatric obesity medicine physicians, bariatric surgeons, child psychologists, anesthesiologists, registered dietitians, and ethics personnel which optimized the personalized treatment strategies for each patient. It was determined that there are numerous unique aspects of performing SG in neuro-atypical adolescents which are dependent on their cognitive, social, emotional, and physical needs. Ethical and behavioral issues like difficulty swallowing pills, explaining the surgical process in an understandable way, and developing strategies to ensure compliance are important to consider. In conclusion, we report encouraging outcomes after SG in neuro-atypical adolescents when done with an individualized family centered approach by a multidisciplinary team.

This work was made possible by the Massachusetts General Hospital for Children Digestive Disease Summer Research Program.

Poster 21

A Spiral Coverage Path Planning Approach for Surveying Small-Scale Coral Reefs with an Autonomous Underwater Vehicle

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We introduce a method that produces coverage paths for small-scale coral reefs. The solution utilizes a highly-maneuverable autonomous underwater vehicle (AUV) without previous knowledge of the reef's size or shape. The solution has two stages. First, using camera and pose estimates from a localization system, the AUV circumnavigates the boundary of the reef, forming a polygonal target which may be convex or non-convex. Second, an algorithm plans a spiral-like path that covers every point in the target space. We present an implementation in a simulated environment and outline the solution's strengths and potential drawbacks.

This material is based upon work supported by the National Science Foundation under grant number 2313928. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.

Poster 22

***Great Expectations* on Page and Screen: Considering How Contemporary Film Adaptations of the 19th Century Novel Depict Coming-of-Age Narratives**

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Great Expectations was written by Charles Dickens and released serially in 1860 and 1861 and has been adapted to film a notable fourteen times. The coming-of-age novel is set in late Victorian England and tells the story of a young boy named Pip, and his journey discovering himself from childhood to manhood after an anonymous benefactor gives him the opportunity to go to London and become a gentleman. We believe that the fascination contemporary filmmakers have with *Great Expectations* comes down to its appeal as a bildungsroman and the satisfaction that a reader feels when following coming-of-age narratives from start to finish. To conduct this study, we considered Pip's growth in two distinctly different arcs: Pip's romantic coming-of age and his moral coming-of-age. To do so, we compared two distinctly different film adaptations of *Great Expectations*, a faithful adaptation from 1946 directed by David Lean based in Victorian England depicting a fairytale version of Pip's story, and the second from 1998 directed by Alfonso Cuarón which takes place in 1980s New York. We considered the consequences of the directors' choices, and how the differences in setting, time, or plot affect the overall presentation of Pip's coming-of-age. Through this comparative analysis of the two films and their individual presentations of these coming-of-age arcs in *Great Expectations*, we realized that the quality of an adaptation is not equivalent to its faithfulness to the novel, but rather to how well it captures the emotions one experiences while reading the novel. For the case of our chosen adaptations the differences were ample, but the root of the story, and Pip's most influential moments remained the same. By establishing romance and morality as individual coming of age narratives for Pip, we were able to consider how David Lean and Alfonso Cuarón each considered romance and moral challenges as catalysts for Pip's coming-of-age, and as a result, how adaptations may continue to successfully bring life to Charles Dickens's novel.

We thank the Weiss Summer Research Program for Financial Support.

Poster 23

The Embrace of Shadows: a collection of short stories

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The Embrace of Shadows is a book of short stories that explores themes of Black and Indigenous persecution during three different time periods in the Dominican Republic. The book begins with the colonial period, a time of slavery, and when the Spanish crown used the Inquisition to cleanse the world of anyone who went against the Catholic Church. The second time period the book covers is 1937, during the Trujillo dictatorship when Haitians in the Dominican Republic were targeted and killed because of their skin color in what is known today as the Parsley Massacre. This sentiment has carried over for decades and has culminated in the contemporary mass deportation of Haitians and Dominicans of Haitian descent by the country's current government, a time period the book covers as well. The first story is "The Last Person on Earth," which introduces Cayguan, a warrior that represents the destruction of the indigenous people of Hispaniola. It is followed by "A Girl Named Tanna," a story about a little girl captured from her home and brought to the Americas. She represents the millions of enslaved girls who became sexual objects during this time. The third story, "The Sight of the Cross," depicts the story of Alonso, a soldier for the Spanish crown in the new world, who is tormented by his crimes and his role in the mass genocide of indigenous people. The fourth story, "The Woman with the Pearl Necklace" depicts a young woman, Ana, who becomes one of the many girls abused by Trujillo; her family becomes victims of the persecution of Haitians despite being born in the country. The book ends with "Death's First Goodbye" in present-day Dominican Republic, where a boy of Haitian descent contemplates how to escape the vicious cycle of injustice and suffering. All the stories written are interconnected by the character of Death, which grants these characters an appropriate ending according to their beliefs and how they lived their lives.

Thank you to the Weiss Summer Research Program for their financial support.

Poster 24

Building an Infinite-Conjugate Optical Microscope

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Recently, infinite-conjugate microscopes have become increasingly popular as they allow auxiliary optical devices to be inserted into the light path without compromising the performance of the microscope. An infinite-conjugate microscope combined with Köhler Illumination is especially useful as Köhler Illumination provides uniform illumination of the specimen under study and control of the field of view and optical power delivered to the specimen. This summer, an infinite-conjugate optical microscope with Köhler Illumination and computer readout was built and optimized. The optical fundamentals of the microscope and its set-up were researched and applied to understanding the microscope's operation and improving its capabilities. A USAF target was imaged with the microscope's computer readout and used to test the microscope's magnification, resolution, and modulation transfer function (MTF), across four different objective lenses. The USAF target consists of four groups of six horizontal and vertical line pairs varying in size. The microscope magnification is simply the ratio of the image and object sizes, while the resolution refers to the level of detail observed within the sample; more specifically, the smallest separation between two points that are distinctly observed as two individual points. The MTF is a measurement of the microscope's ability to transfer contrast from the sample to the image plane at a specific resolution. Measurements of the microscope's magnification agree with the expected magnification once a correction is made for the focal length of the microscope's tube lens. The experimental resolution of the microscope did not reach the diffraction limited, theoretical resolution, while the measured MTF matches the theoretical, expected MTF when imaging fine, smaller elements on the target. When imaging larger elements, the measured MTF exceeds the theoretical prediction.

We thank the Weiss Summer Research Fellowship Fund in Natural Sciences and Mathematics for financial support.

Poster 25

The Agricultural Productivity Gap: Evidence from Uganda

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College of the Holy Cross

Many studies have found a wage/welfare gap that exists between workers in agriculture and other sectors in both developing and developed economies. The economics literature has sought to explain if this is due to worker misallocation while also looking at the role of worker differences. Building upon past studies, we examine the role of observable and unobservable worker characteristics using updated household survey data from Uganda. Our focus is on those who are employed in agriculture, manufacturing, and services. We control for observable worker characteristics by using age, education, gender, and region. Unobservable characteristics are controlled for by addressing the impact on consumption for those who switch from agriculture into manufacturing or services. The dependent variable of interest is adult equivalent consumption which serves as a proxy for welfare by adjusting household consumption based upon a member's age. We find that unobservable worker characteristics explain more of the welfare gap than observable worker characteristics. When observable characteristics were controlled for, the welfare gap between agriculture and services declined over time from 2010. However, when elementary occupations (e.g., cleaners, food preparation assistants, and street workers) are included in services, the welfare gap reversed in 2019-2020. Considering how elementary occupations are categorized as unskilled and have low pay, these findings are consistent with our expectations. When controlling for unobservable characteristics, the welfare gap between workers in agriculture and services disappears. However, once workers who hold elementary occupations are no longer counted amongst service workers, there is a welfare gap that is not explained by unobservables. Furthermore, for workers who remained in agriculture, higher levels of education do not result in higher welfare. Therefore, these workers would have been better off switching into manufacturing.

We would like to acknowledge the Weiss Summer Research Program in Economics for financial support.

Poster 26

A novel behavioral intervention to promote adherence in heart failure (Reach for Health)

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C. Massey, and E. Puglisi*

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Despite the known benefits of adherence to a low-sodium diet, physical activity, and prescribed medication, individuals with heart failure (HF) struggle to adhere to these practices. Existing health behavior interventions have several limitations that affect their accessibility and efficacy. Accordingly, we created Reach for Health, a 12-week, phone-delivered program that combines motivational interviewing (MI) and positive psychology (PP) to promote both well-being and health behavior adherence. MI is a counseling approach effective in increasing self-care engagement but has not consistently improved physical symptoms. PP involves activities to enhance well-being, such as using strengths in a new way. In this randomized controlled trial, we aim to examine the efficacy of the Reach for Health program – compared to an MI-based educational condition – in 280 adults with HF and suboptimal adherence to physical activity, a low-sodium diet, and/or medication recommendations. All participants learn about each health behavior and set goals during weekly phone sessions with a study trainer. Participants in the Reach for Health condition will then complete a PP activity and work towards a health behavior goal each week. Follow-up visits occur at 12-, 24-, and 48-weeks post-randomization. The primary outcome is a composite score of health behavior adherence, comprised of physical activity (steps/day), 24-hour sodium excretion, and medication adherence. We will assess the intervention’s impact on psychological, functional, and cardiovascular health outcomes. Recruitment for the study began in November 2021 and is ongoing. We hypothesize that the PP-MI intervention will significantly improve health behavior adherence, psychological and functional outcomes, and show non-significant improvements in medical variables.

I thank the MGH Translational and Clinical Research Center and the College of the Holy Cross Crusader Fund for financial support.

Poster 27

Investigation of the function and evolution of *goddard*, a *de novo* evolved gene essential in male *Drosophila* fertility

K. L. McDermott, P. H. Patel, and G. D. Findlay
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De novo evolved genes arise from previously non-coding regions of DNA. Many *de novo* genes are expressed in male reproductive systems, suggesting roles in fertility. Research has shown that *goddard* is essential for male *Drosophila* fertility, as CRISPR/Cas9-mediated knockout of *goddard* causes male sterility. Reintroduction of *goddard* in a rescue construct restores male fertility to nearly wild type levels. Within the testes, Goddard localizes to spermatid axonemes and transition zones and functions in spermatid individualization. Here, we attempt to characterize the function and evolutionary history of *goddard*. We created transgenic *melanogaster* flies knocked out for endogenous *goddard* and containing the *goddard* sequence of *D. ananasse*, *virilis*, *mojavensis*, or *grimshawi*. We used confocal microscopy to observe the localization of Goddard in *melanogaster* testes and conducted a fertility assay. Flies with *melanogaster* or *mojavensis* *goddard* show normal Goddard localization in the testes, axonemes, and transition zones, and fertility restoration. Flies with *ananasse* or *virilis* *goddard* show normal Goddard localization but are sterile. Flies with *grimshawi* *goddard* show abnormal localization and sterility. This suggests that *ananasse* and *virilis* Goddard encounter a non-localization problem which prevents fertility function in *melanogaster* flies. *Ananasse* is the closest ortholog to *melanogaster*, while *virilis* and *mojavensis* are equally more diverged. Thus, fertility restoration by *goddard* orthologs in *melanogaster* flies does not correspond to their evolutionary distance from *melanogaster*. To further assess *goddard* conservation and protein function, we have created rescue constructs of *D. simulans* and *D. yakuba* *goddard* sequences, as well as two truncated *goddard* sequences, yet to be analyzed. We will use the data with predicted structures of each species' Goddard protein to learn which regions of the protein are responsible for its fertility function and determine how *goddard* evolved essentiality in *Drosophila*.

We thank Carol and Robert C. Gibbons '67 and the National Science Foundation for financial support.

Poster 28

De novo evolved gene *atlas* and its effect on male fly fertility

A. G. Wambui and G. Findlay

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De novo genes evolve from previously non-protein-coding regions of DNA. My research centers on the function and evolution of a specific *de novo* gene, *atlas*, and its role on male fruit fly fertility. Our lab previously found that the *atlas* gene is required for DNA packaging in developing sperm cells, yet the gene's sequence is changing rapidly between closely related fly species. Other prior research found that the knockout of *atlas* results in almost complete sterility in males suggesting that it is required for male fertility. In order to gain insight into the evolution of novel genes and determine whether these rapid changes in the *atlas* sequence affect its function, we plan to insert different *atlas* orthologs from various species into *atlas* null *Drosophila melanogaster* flies and assess male fertility. As a control for these experiments and to validate our strategy of tracking *atlas* localization with GFP, we first introduced a GFP-tagged transgene that contained *D. melanogaster atlas* expressed under ~2kb of its regulatory sequences. We showed previously that an *atlas*-GFP knock-in allele produced detectable Atlas protein in condensing spermatid nuclei and enabled full fertility, so we predicted that the *atlas*-GFP transgene would show the same properties. However, when we imaged the testes, the GFP tag could only be detected by antibody staining, suggesting much lower protein expression, stability or detectability. We are currently trouble-shooting this experiment by: 1) generating flies that are homozygous for the transgene in the *atlas* null background; 2) measuring these flies' fertility to assess genetic rescue; and 3) sequencing the *atlas*-GFP transgene that has been integrated into the fly genome.

We thank the National Science Foundation for financial support.

Poster 29

Role of *katherine johnson* in *Drosophila melanogaster* fertility

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De novo genes are genes that arise from previously non-coding regions of the genome. In *Drosophila melanogaster*, many *de novo* genes are expressed in the testes, a few of which have been found to be essential for male fertility. *katherine johnson* (*kj*) is one such evolved gene, as *kj* knockout males show a significant decrease in fertility levels when crossed with wild-type females. To gain insight into the cellular function of the KJ protein, we created a version of the protein with a C-terminal HA biochemical tag. This KJ-HA protein localized to spermatocytes, but was not detectable in post-meiotic spermatids and mature sperm. This result was surprising, because imaging of wild-type and mutant testes showed that spermatogenesis completes normally in mutant males. Furthermore, sperm from *kj* null fathers are present in normal levels in mated females, suggesting an issue with sperm motility or fertilization ability. We are thus exploring the possibility that KJ protein may be present at later spermatogenesis stages and/or in mature sperm. To do so, we have created two new tagged versions of the KJ protein: one with an N-terminal HA tag, and the other with a N-terminal GFP tag. We are currently integrating these tagged transgenes into the *kj* null background and will use the resulting lines to determine the possibility of alternate localization patterns of *kj* protein. Preliminary imaging of testes from the GFP-KJ line shows a different pattern of KJ-GFP localization compared to the KJ-HA line. This may suggest that KJ protein is normally present at later spermatogenesis stages or in mature sperm, but further investigation is required.

We thank Mark and Janine S. Kelly '91 P22 for their generous financial support and the National Science Foundation for additional funding.

Poster 30

Functional Consequences of a *De Novo* Evolved Gene Across *Drosophila* Species

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De novo evolved genes arise from previously non-coding regions of DNA. Some of these genes can evolve functions that become essential to the organism. Our lab has identified a *de novo* gene, *saturn*, which is required for proper sperm production and motility in *Drosophila melanogaster* fruit flies. We previously found that *saturn* has undergone rapid evolution across *Drosophila* species. To test whether the rapid evolution of *saturn* has functional consequences for the gene's function, we inserted *saturn* orthologs of different *Drosophila* species into *D. melanogaster* flies lacking an endogenous copy of *saturn*, in an attempt to rescue fertility. We observed that orthologs from species closely related to *D. melanogaster* functioned well in rescuing fertility, while more divergent orthologs were less effective. The ortholog of *D. ananassae*, in particular, yielded fertility results similar to that of *saturn* null males. One focus of our research this summer was the development of a purified *D. ananassae* Saturn protein for the purposes of raising an antibody. This will allow us to observe the localization of Saturn in *D. ananassae* testes. In addition, we conducted confocal imaging of whole mount testes dissections to observe abnormalities in spermatogenesis during *saturn* fertility rescue. This will allow us to pinpoint why there is a significant loss in fertility rate when the *ananassae* ortholog is inserted into *melanogaster* testes. All together, these experiments will allow us to identify the key evolutionary steps by which the *saturn* gene evolved its essential fertility function in *Drosophila melanogaster*.

We thank the National Science Foundation and Mark and Janine S. Kelly '91 P22 for financial support.

Poster 31

Post-Transcriptional Regulation of *atlas*, a *De Novo* Evolved Gene Critical for Male Fly Fertility

I. Jagusah, P. Patel, and G. Findlay

Department of Biology, College of the Holy Cross

To understand how new genes are created and become essential to biological processes, our research lab studies *de novo* genes. *De novo* genes arise from previously non-coding sections of DNA that gain an open reading frame, which can then be transcribed and translated. One such *de novo* gene, *atlas*, is critical for male fly fertility and the normal development of sperm in the testes. Transcripts of *atlas* have two isoforms, RA and RB, which differ in the length of their 3' untranslated regions (3' UTRs). While 3' UTRs are not translated into proteins, previous studies show that they can play a role in post-transcriptional regulation, meaning that these regions can control when and how transcripts are translated into proteins. Previous data from our lab has shown that the shorter RA isoform is present at ~3-fold higher levels than the longer RB isoform. To test whether the RB isoform was important for *atlas* gene activity, we used CRISPR to delete the RB-specific portion of the *atlas* gene. Males homozygous for the RB-only deletion were more fertile than *atlas* null flies, but exhibited reduced fertility in sperm depletion assays, suggesting that the RB-specific region of the *atlas* gene may be important for maintaining sperm production. One possible mechanism through which the RB region could affect Atlas protein expression is by serving as a binding site for proteins that affect the localization, stability, or accessibility to ribosomes of *atlas* transcripts. To assess transcript localization, we are developing *in situ* hybridization methods that can detect full *atlas* transcripts and *atlas* transcripts containing the RB isoform. We can then compare *atlas* transcript localization in control and RB-deleted flies and analyze the differences of the two isoforms.

We thank the National Science Foundation (grant #2212972) for financial support.

Poster 32

Analysis of Wave Transmission over Reef-like Structures in FUNWAVE-TVD

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In the coastal engineering community, interest in constructing living shoreline infrastructure to provide coastal protection and ecological restoration is growing but there is a gap in knowledge on how to numerically model these structures accurately. The permeability and shape of submerged structures affect wave transmission in the nearshore, among other processes. In this study wave transmission was modeled in FUNWAVE-TVD, a depth-averaged, phase-resolving numerical model that solves the fully nonlinear Boussinesq equations in the intermediate and shallow water regimes. Three monochromatic wave climates were generated in quasi-one-dimensional domains. Submerged structures were modeled via two methods: altering the impermeable bathymetry of the domain while varying the bottom friction coefficient and adding a dissipative sponge layer in the water column while varying its width and absorption coefficient strength. Results indicate that the first method captures nonlinear dispersive effects of shoaling and breaking over reef-like structures while the latter dissipates wave energy. Ongoing data collection and statistical analysis will provide general and application-specific guidance on how to use these methods together. Next steps will include modeling irregular wave climates at varying depths and real-world seaward bathymetries while expanding into two-dimensional domains.

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Poster 33

The Impact of the COVID-19 Lockdown on Individuals with Autism Spectrum Disorder (ASD): A Meta-Analysis on the Expression of ASD Symptoms and Emotional Well-Being of Those Diagnosed with Autism and Their Caregivers

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Among the many difficulties associated with Autism Spectrum Disorder (ASD) are those related to adapting to changes and new situations. Routines can be a helpful aspect to an autistic individual's life because daily routines, no matter how small, can help create order in their life by helping them learn what to expect, when to expect it, and how to react. The COVID-19 pandemic disrupted daily life, including daily routines, due to the home-confinement period that was put into place at the beginning of the pandemic. ASD individuals were particularly vulnerable to the development of psychiatric symptoms during the pandemic. Some individuals with autism displayed higher levels of aggression, irritability, and other ASD-like symptoms during the home-confinement period. This could be caused by several factors, such as heightened screen exposure, disruption of routines, and increased time with family and caregivers. Therefore, the disruption of structured routines and the learning of new ones during the lockdown period caused ASD symptoms and emotional well-being to worsen. Along with worsening ASD symptoms, parents and caregivers are at a higher risk of developing anxiety and depression. This meta-analysis dives into the correlation between the COVID-19 lockdown and an increase in the expression of ASD-like symptoms and the correlation between caregiver anxiety and a worsening of the emotional well-being of individuals with ASD.

I thank the Autism Speaks Science Department for making this research possible.

Poster 34

Dog Days of Summer:

Aging in Canine Lung Mesenchymal Stem Cells

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Stem cells, or cells that maintain the potential to differentiate into several specialized subtypes, are an important factor in aging because of their role in regeneration and healing. As these cells get older, however, they begin to lose some of these useful capabilities. Our goal with this project is to characterize differences between young and old canine lung stem cell lines in order to ultimately determine some of the molecular mechanisms by which aging occurs. To do this, we collected data from a number of canine lung stem cell lines, varying in age and breed, by performing several different assays that gauged migration capacity, proliferation rates, reactive oxygen species presence, and autophagy capabilities. Our main focus thus far has been on scratch assays, which assess the migration capacity of these cells. This assay entails making a fake wound on a plate of cells in order to gauge how readily cells migrate to close the gap. Up to this point, we have not found any significant difference in migration rates of young and old dogs.

We thank the Weiss Summer Research Program for financial support.

Poster 35

Children's Literature in the Long Eighteenth Century: Discovering the Child and the Artist

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Early English society largely did not recognize the distinct interests of children. While there is no exact date when “childhood” was discovered, institutions that catered to young people burgeoned in the eighteenth century, among them the publishing industry. My project examines the overlapping roles of eighteenth-century authors, publishers, and illustrators to provide a short history of English children’s literature. I then turn my focus to Mary Wollstonecraft’s *Original Stories from Real Life* (1788), with illustrations by William Blake, and *Mrs. Leicester’s School, or, The history of several young ladies* (1809), by Mary and Charles Lamb. I argue that Wollstonecraft and Blake created a dialogue between their work that portrays the educator Mrs. Mason as a protective and affectionate female figure, with Blake using body language and religious iconography to cast a positive light on Wollstonecraft’s protagonist. *Mrs. Leicester’s School* is much less studied, yet its innovative purpose and stylized pictures promote understanding in young readers while providing rich artistic associations. With the understanding of material culture and history, I drew on my studio art background to create multiple handmade chapbooks. The story within my chapbook, titled “The Sailor Uncle,” is the first short story in *Mrs. Leicester’s School*. The story follows Elizabeth Villars, who overcomes the death of her mother with the help of her uncle. I carved six linoleum blocks, with subjects ranging from tigers to graveyards. I then printed the blocks in five small books that I sewed together. Each print carefully considers contrast and symbolism to amplify the themes within “The Sailor Uncle.” This project contributes to the artistic culture of children’s illustration by rectifying past perceptions and producing compelling new media.

We thank the Weiss Summer Research Fellowship in Humanities, Social Sciences, and Arts.

Poster 36

How do Books Work? Digitally Analyzing Homeric Manuscripts

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The tenth-century Venetus A manuscript of Homer's *Iliad* preserves a unique collection of more than 9,000 marginal notes (*scholia*), deriving from the work of scholars as early as the third and second century BCE. My research analyzes how scribes designed the layout of manuscript pages drawing on these diverse sources. Current scholarship has suggested that the *scholia* are simply positioned as close as possible to the line they comment on, but this argument has been based on visual inspection of only a handful of sample pages. Nikolas Churik '15 looked at pages with very few *scholia*, where many of the notes are clearly not as close as possible to the line they comment on. Churik hypothesized that pages are instead organized in distinct zones, like the footnotes at the bottom of a modern printed text. My research systematically analyzes hundreds of pages of manuscripts from digital editions recording the position on the page of each *Iliad* line and each note. I created a package in the Julia programming language that used mathematical optimization to model both the traditional hypothesis and Churik's hypothesis, and compared the predicted results under each hypothesis to the actual position recorded in the digital edition. I summarized the results for each page as a score of how many *scholia* were correctly predicted by each hypothesis. Our work is still in progress, but initial results favor the Churik hypothesis for most pages. While this study is focused on the Venetus A, the Julia package I created called MSPageLayout can be used with any Homeric manuscript to apply the same tests.

Thank you to the Weiss Summer research program for their financial support.

Poster 37

The Development of Undergraduate Physical Chemistry Lab Experiments

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Physical chemistry explains the basic principles of molecular interactions establishing a base for other chemistry disciplines to be constructed. Holy Cross's chemistry major only requires one course that exclusively focuses on this foundational topic: Quantum Mechanics. To ensure Holy Cross graduates are aligned with fellow chemistry professionals in the workplace, the semester of the course and laboratory work must be efficient in maximizing the skills and concepts covered. Comparing the current curriculum to similar institutions allowed for a comprehensive understanding of the changes needed to allow the understanding of physical chemistry to be in alignment. The primary step in the revision process was conducting a thorough literature search to discover the possibilities for new experiments. The first lab utilized a natural chemistry approach to create gold nanoparticles using black tea and HAuCl_4 . The second lab outlined the principles of quantum confinement through the construction of CdSe quantum dots. The new experiments were evaluated, analyzed, and conducted again to ensure their accuracy in the laboratory. After the development of the new procedures, pre-existing experiments were conducted to clarify the existing curriculum. The future of the Holy Cross physical chemistry curriculum must consider not only the student experience but also the ability to prepare students for their future endeavors.

I appreciate the support from the NSF Career Award under Grant No. 2045012, the College of the Holy Cross, and the Weiss Summer Research Program for funding this research.

Poster 38

Investigating Self-Assembled Monolayers of Dodecanethiol and 4-Terphenylthiol on Au(111) using Scanning Tunneling Microscopy

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Self-assembled monolayers (SAMs) of 4-terphenylthiol (TPT) and 1-dodecanethiol (DDT) were prepared by deposition onto a flame annealed chip of Au(111) on mica. A SAM is a single layer of molecules that forms on the surface due to chemical interactions between the thiol head group and the gold atoms of the substrate. The SAMs were studied using scanning tunneling microscopy (STM), which uses variations in electrical current and quantum tunneling to map the topography of the surface. The molecules were first studied independently to determine the ideal deposition conditions and to characterize the surface structures formed alone. Binary SAMs were prepared by sequential deposition of TPT and DDT to study the surface mixing of these molecules when adsorbed together on a substrate. Preliminary results show that DDT does not form ordered monolayers and TPT does form ordered SAMs.

We appreciate funding from the NSF Career Award under Grant No. 2045012, the College of the Holy Cross, and the Weiss Summer Research Program.

Poster 39

Swiss Stained Glass in America: An International Project with Swiss Researchers to build their Open-source Database, Vitrosearch

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Beginning in the 16th century, stained glass windows began to appear ever more frequently throughout Swiss cities villages. These were windows of the “working class” whose labor had made them prosperous enough to donate a small panel for insertion into the lattice windows of an inn, town hall, parlor or church. These people, for the most part, had not inherited their wealth, but were a part of the local citizenry who had prospered from changing political and social structures and were eager to demonstrate their loyalty to civic and religious organizations. Measuring about fourteen by ten inches, the panels celebrated marriage alliances, trade guilds, and professions. While in other areas a coat of arms was associated with nobility, Switzerland’s political history of democracy allowed most citizens to have their own coat of arms, regardless of class. Many of these “badges” proclaimed the trade of the individual: a farmer’s plowshare, a vintner’s pruning knife, a tailor’s pair of shears, or a baker’s pretzel. Dedicated to the research of stained glass, the Vitrocentre, in collaboration with the Vitromusée Romont, has created the Vitrosearch online, open—access database: a tool for publishing research and for showcasing objects, while simultaneously, through their digitization, preserving the glass works as an important historic cultural asset. We have been working closely with the research center, creating entries for almost half of the American-owned Swiss stained-glass panels. In doing so, we have visited and been privately toured through archives at the Morgan Library, New York, NY; Wadsworth Atheneum Museum of Art, Hartford, CT; Mead Art Museum, Amherst, MA; and the Harvard Divinity School Library, Cambridge, MA.

We thank the Weiss Summer Research Program for financial support.

Poster 40

COVID-19 Vaccine Take-up: The Role of Health System Engagement

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Does engagement with the health care system (HCS) determine vaccine take-up? Directly addressing this question is challenging since individuals who elect to engage with the HCS are likely more health conscious which in-itself can lead to higher vaccine take-up. Utilizing state variation in Medicaid expansion, this project aims to address the causal relationship between HCS engagement and vaccine take-up in the context of Medicaid and the COVID-19 vaccine. Studies support that Medicaid expansion states experienced increases in Medicaid coverage and decreases in uninsurance rates. The literature supports that Medicaid coverage increases HCS engagement using proxies such as prescription drug fill rates, HPV vaccine initiation, use of preventative services, and physician interaction. To analyze the effect of HCS engagement in the context of the COVID-19 vaccine, this project utilizes three main datasets: (1) The Census Bureau's Household Pulse Survey, (2) The CDC's COVID-19 Vaccination Equity dataset, and (3) The Census Bureau's National Health Interview Survey. Aside from their own nuances, each dataset includes demographic, geographic, health insurance, and vaccination data. Using difference-in-difference regression analyses, we find a positive association between COVID-19 vaccine take-up and Medicaid eligible populations residing in expansion states across all three datasets. The 2SLS shows a similar effect: Medicaid enrolled individuals are 0.6 percentage points more likely to initiate the COVID-19 vaccine. Albeit not statistically significant, the relevance of the effect sizes could be reframed in terms of economic significance extrapolated from associated hospital expenses and short to long term effects from a marginal reduction in COVID-19 prevalence.

We thank the Weiss Summer Research Program for financial support.

Poster 41

Short-circuiting and Degradation in Proton-Exchange Membrane Fuel Cells

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Air-Cooled Stacks Engineering, Plug Power Inc.

Proton-exchange membrane fuel cells (PEMFC) are composed of two compartments: an anode and a cathode. Hydrogen (H_2) flows from the anode compartment to the cathode, where it reacts with a supply of oxygen (O_2) to form water. In between the compartments lies the membrane electrode assembly (MEA), a layer which is critical for proper cell function. The MEA contains a platinum catalyst that separates the H_2 supply into protons and electrons on the anode side and facilitates the reaction between oxygen and hydrogen ions on the cathode side. The practice of short-circuiting (also known as shunting) between the anode and cathode compartments is commonly used throughout the fuel cell industry, as it provides a significant boost in power output. Recent studies, however, have shown that shunting may reduce cell lifetime by damaging the platinum catalyst through the Ostwald Ripening mechanism when it is used while the cell is voltage cycling at voltages greater than 750mV per cell. At Plug Power, we performed 100+ hour accelerated stress tests on three 3-cell versions of our air-cooled PEMFC stack products to assess the effects of the degradation mechanism. We varied the voltage pulses of each station while maintaining a constant hydration state and collected the current output data to analyze cell performance. We also used a potentiostat machine to run electrochemical surface area measurements at the beginning and end of life which provided the surface area of reactive sites on the MEA. Station 1 was held constant at 2.1V (700mV/cell), station 2 was held constant at 2.1V for 60 minutes and then pulsed to 2.4V (800mV/cell) for 120 minutes, and station 3 was held constant at 2.1V for 60 minutes and then pulsed to open current voltage (OCV, ~900mV/cell) for 120 minutes. Our study confirmed that shunting does significantly reduce current output and electrochemical surface area measurements through Ostwald ripening.

We thank Dave Lott and Joe Watkins for managing this internship and Plug Power for providing compensation.

Poster 42

Temporary Eelgrass Diebacks Have a Limited Effect on Carbon Stocks in the Lower Chesapeake Bay

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Seagrass meadows are essential coastal ecosystems that play a key role in blue carbon storage. These meadows naturally sequester and store the majority of their organic carbon in sediments, where it can accumulate over centuries. In the lower Chesapeake Bay poor water quality and extreme high temperatures are resulting in repeated Eelgrass (*Zostera marina*) die-offs, with potential implications for its belowground carbon stocks. Here, we investigated the impacts of one-year die-offs in Eelgrass cover on carbon stocks in the lower Chesapeake Bay. To conduct this study, we collected sediment cores and aboveground biomass samples in Mobjack Bay from May to July. Sediment cores were processed for moisture content, dry bulk density, and percent organic matter. Downcore average percent organic matter was found to be slightly higher in Eelgrass meadows in Mobjack Bay compared to meadows in a 2013 study conducted on Virginia's eastern shore. Additionally, preliminary results suggest that Eelgrass meadows undergoing a one-year dieback can retain their carbon stocks through the short-term disturbance. A one-year die-off may be too short of a disturbance to result in substantial carbon loss. The stability of coastal carbon stocks within a working seascape is dependent on the ability of seagrasses to recover from short-term disturbances. Additional sample processing of seagrass carbon stock data will help inform future and present restoration measures in their preservation of Eelgrass as a blue carbon ecosystem.

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Poster 43

Agricultural Household Impacts of Guinea Worm Eradication

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Dracunculiasis is a parasitic waterborne infection caused by the roundworm *Dracunculus medinensis*, also known as Guinea worm. When a human is infected with Guinea worm, the individual has a chance of being permanently debilitated and be unable to work. Previous literature suggests that debilitating illnesses including HIV decreases the metrics that indicate standard of living such as agricultural output and school attendance. However, medical intervention such as access to antiretroviral therapy have been shown to increase these standard of living metrics. The World Health Organization, The Carter Center, and the United Nations collaborated to initiate the International Drinking Water Supply and Sanitation Decade in order to eliminate waterborne illness such as Guinea worm in the 1990's. This program, along with other interventionist programs, led to a swift decrease in the cases of guinea worm in countries such as Nigeria, Sudan, and most importantly, Ghana. The purpose of this research was to investigate the eradication of Guinea worm in Ghana and its impact on agricultural health. To measure agricultural health, the yearly average NDVI (Normalized Difference Vegetation Index) was measured. IPUMS Data was gathered on Ghana over 40 years from 1981-2020 on the district level. Each of the 260 districts every year reported data on NDVI. Additionally, Guinea Worm rates from 1984 and 1989 were measured in each district. As the country was redistricted from 140 districts in the 1980's to 260 districts in 2020, software such as QGIS was used to match old districts to new districts, allowing each modern district to be associated with a guinea worm rate from 1984 and 1989. With a complete dataset, multiple robust regressions were performed in order to find the covariance and connection between NDVI of a district and their Guinea Worm rate. Additional variables that were considered included a lagged measure of temperature and precipitation in order to remove the effects of weather on NDVI.

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Poster 44

The Significance of Ecological Inference, Voter Turnout, and Population Makeup in Georgia's 2016 and 2020 Elections

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Gerrymandering is a concept that uses the power of redistricting to favor political views, change the dynamic of voting, and can also be used to suppress voices. Throughout this project we used a mathematical perspective to understand elections while considering the Voting Rights Act, laws, and histories. In particular, our project centers on the impact that factors such as voting preferences, turnout rates, and population makeup has affected the outcomes of Georgia's elections, specifically in the 2016 and 2020 elections. Georgia has some fast-growing cities, districts that are majority minority, and this state has a history of racial gerrymandering. We used raw data to gather information about precincts and districts from Georgia's 2020 State Senate map. With the data provided we created averages of the citizen voting age population (CVAP) makeup, turnout rates, and also created an estimation of the 2016 CVAP by using 2020 and 2019 CVAP ratio. In addition, we used a statistical technique called Ecological inference (EI) to determine the preferences of minority communities in state elections. This statistical method uses the total number of casted votes in a particular race and the percentage of minority communities to calculate the preferred candidate of the minority community. One of our goals was to run ecological inference by district in order to see where there has been racially polarized voting and to compare the EI of the Black and Hispanic populations from 2016 to 2020. Ultimately, we used a multilinear regression model to see how the turnout rate, the Black and Hispanic population, and the EI of the Black and Hispanic population affected the outcome of the preferred candidate for each individual race.

This project was supported by a grant from the National Science Foundation and by the Weiss Summer Research Program.

Poster 45

“L'esprit qui ne doute pas ne cherche pas” An Analysis of the Counter-Reformation Religiosity of Michel de Montaigne

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The sixteenth-century was a century of innovation. From the Protestant Reformation to revelations about our world and what lies beyond it, the period is admired for its ceaseless curiosity and ambition. Amidst this era of much renown exists a figure best defined as such: Michel de Montaigne. Montaigne was a French nobleman most famous for authoring his *Essais*. Among other things, he was known to be an arbiter during the French Wars of Religion, serving as a prominent political player as mayor of Bordeaux in the 1580s. Due to the nature of some of his *Essais* and the hotly contested religious disputes of the time, many have doubted he was religious in a traditional sense. A man of constant questioning, he came under suspicion of the watchful eyes of the Catholic Church. Given his works and willingness to cooperate with leading Protestants during the Wars of Religion as well as the Church's own appropriation of wariness, many historians have continued to doubt the sincerity of his religious beliefs. In seeking to further define his religiosity, I, with the aid of Doctor Bush, have read sources in French and in translation, ranging from primary sources such as his *Essais*, his travel journal, and Jesuit sources, as well as much historiography surrounding him. Through this, we have come to the conclusion that he is best seen as a Catholic of the Counter-Reformation — one who much like those of his time doubted and in doing so found. Exhibiting characteristics of conservative Catholics in writing and practice, a like mindedness with certain Jesuit values, and a willingness to recognize the changing nature of the religious world around him, his religiosity ought not to be doubted.

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Poster 46

Stem Cell Proliferation in *Hofstenia miamia*:

Does It Change With Age?

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Three-banded panther worms, or *Hofstenia miamia*, exhibit the incredible ability to regenerate themselves. This phenomenon is the result of their highly prolific mesenchymal stem cells, also termed as neoblasts. In this study, we look at how stem cell proliferation changes with age in *Hofstenia miamia*. In order to gain insight into this process, we conducted various assays on the worms, which were separated into four groups in accordance with age. This included a regeneration assay, where we cleaved worms of different ages into their respective heads and tails. Following this, we took pictures, as a means to gain qualitative insight as well as numerical data depicting the worms' regeneration. As another means to measure regeneration, we took timelapses of the worms as a way to quantify movement, evidence of neural activity in the anterior end of the worm, indicating when a worm tail regenerated its head. The pictures and timelapses were subsequently analyzed using ImageJ and R software. Additionally, the feeding habits of the worms were measured to determine the regeneration of the worm's pharynx. In order to do this, the experimental worms were subjected to five (first assay) or three (second assay) brine shrimp to feed on. Higher levels of regrowth, movement, and feeding would all allude to higher quantities of mesenchymal stem cells. However, with the data collected in this study, this cannot be determined, as there were no significant findings yet.

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Poster 47

Profiling the Energy and Spatial Distributions of a Proton Beam

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In tokamak fusion reactors charge transfer collisions occur between hydrogen ions and lithium atoms which come from the reactor's lithium-coated walls. Such collisions affect the properties of the fusion plasma and are important to understand if tokomaks are to successfully create self-sustaining fusion reactions. Experiments in our lab mimic these collisions using intersecting beams of lithium atoms and protons, and the success of our experiments depends on understanding the properties of these beams. The work presented details 1D and 2D measurements of the proton beam spatial profile and measurements of the proton energy distribution. The beam's horizontal spatial profile was determined by moving a blocking plate across the beam and measuring the number of protons allowed to pass by the plate. Using this method, we found a full width half max (FWHM) of 0.34 inches. We also measured the 2D beam profile (horizontal and vertical) using a new detection device called the beam profile monitor (BPM). These profiles were measured for the unobstructed proton beam and yielded similar FWHM values to that determined by the blocking plate method. In another test, the proton beam was passed through a 4 mm diameter hole and then profiled with the BPM. This was to mimic the apparatus used in the collision experiments and confirmed a narrower spread of protons and a more defined Gaussian distribution compared to the unobstructed beam. We also measured the proton energy distribution using a faraday cup detector while applying a voltage to the detector's entrance cap. As this voltage was increased, only higher energy protons were able to enter the cup and be detected. The negative differential of the detected proton number with cap voltage gave the proton energy distribution. The mean energy of the beam was ~ 85 eV.

We thank the Weiss Summer Research Program for financial support.

Poster 48

Variations in the Index of Refraction and Spectrum for Free Running Diode Lasers at Near-Infrared Wavelengths

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Most semiconductor lasers are marketed to operate at a single mode frequency (or wavelength) when lasing, but this is far from reality. Despite this, semiconductor diode lasers have a wide array of applications in several different industries due in large part to their fast switching time and their frequency tunability. This work explores how semiconductor lasers emit light at different mode frequencies, which depend on nL , the product of the index of refraction, and the chip length. The frequency is tuned through change of the index of refraction and thermal expansion of the laser chip, both caused by electric current passed through the chip. In our experimental setup, we sent light to both a custom spectrometer and a Fabry-Perot analyzer allowing for analysis of shifts in frequency as we change the current injected into the laser chip. The broader range of the frequency spectrum reveals the gain curve, which describes the frequencies of light amplified by the semiconductor material. The index of refraction decreases when an increasing number of injected electrons are sent into the higher energy level (the conduction band), which is most significant while it is below the threshold current. When the population of electrons at the higher energy level increases to be slightly greater than that in the lower level, stimulated emission becomes possible, and laser emission occurs. Above this threshold, the changes in frequency are almost entirely dependent on thermal expansion because the upper electron population is nearly constant. Additional electrons instead are converted immediately into photons by stimulated emission. The theoretical model based on these factors aligns very closely with our experimental results.

We thank the Weiss Summer Research Program for financial support.

Poster 49

Data Analysis on Butterfly Images

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In this project, we tested whether topological data analysis techniques can be used to classify butterfly images. We analyzed a dataset from Kaggle consisting of 830 images of 10 species of butterflies in nature ranging from $n = 50$ to $n = 100$ of each type. For each image, there is also a segmented image, where the background is black. Pre-processing involved converting segmented images to grayscale and smoothing to remove noise. We applied the method of lower star image filtration to the smoothed images using pixel values. For each bright region in the grayscale image, we determined the difference in intensity between the brightest pixel in a region and the darkest pixel in the boundary of the region. This difference is called the lifetime of the region. A persistence diagram is a scatter plot of the lifetimes of the bright regions vs the negative of the intensity of the brightest pixel. A persistence diagram is replaced by a weighted sum of Gaussians (one for each point in the diagram). This is integrated to produce a 25×25 image called the persistence image, which is vectorized for further analysis. We applied dimension reduction technique UMAP and k-means clustering to the set of persistence images. We used UMAP to project vectors of length $625 = 25 \times 25$ to 3-D space, and then applied k-means clustering to the UMAP data with $k = 10$. We analyzed the distribution of butterfly species in these clusters. The result shows that only Giant Swallowtail was successfully classified while other species were split among 2 or more clusters. We conjecture this is due to the variation in images, for example, the position of the butterfly in the image, and the fact that information about the position of bright regions is not preserved by this method.

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Poster 50

Reconsidering the Latvian national awakening: From national independence to the agricultural dictatorship

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As one of the several new-born European states from the collapse of the Russian Empire after WWI, Latvia was not a stable region since it was founded in 1920. Even before the independence, Latvia was still full of racial injustice and tension. Since the 12th century, Latvia was under the serfdom exploitation of Baltic nobles who were compelled by the German nobles who came to this land with the triumph of the North Crusade. The racial injustice created cultural obstacles and hatred among Baltic Germans and local Latvians. The conflicts and hostility between Latvian and German nobles reached a peak in the mid 19th century while the national awakening movements started thriving in East Europe. The national awakening triggered the Latvians to explore their own path to forming an independent state without influences from foreign powers. One of the most important figures who pushed for independence was Karlis Ulmanis, a founding father and dictator of Latvia during the interwar period. Ulmanis tried to revoke Latvian nationalism with the connection of land and agriculture. This decision was caused by his private preference and the history of Latvia. Ulmanis was long exiled in the United States and studied at the University of Nebraska. Graduating with a degree in agriculture, he managed a failed dairy business in America. His experiences at the university strongly influenced his idea of developing Latvia's agriculture industry over industrialization. Land was also a central theme of Latvia's history. Before independence, local Latvians were serfs in lands controlled by the Baltic German nobles. The Land Act of 1920 gave the land back to Latvian farmers. As one of the greatest triumphs of Latvia's independence, the taking back of lands became a symbol for the Latvian Republic and a motivation for patriotism. The bond between national independence and the land became the most important topic for Latvian nationalism during the interwar period both from the private choice of the nation leader and the historical context of Latvia.

We thank the Weiss Summer Research Program for funding this work.

Poster 51

Using Data Science to Understand Students' Perception of Pedagogy in STEM Courses

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Our research objective is to understand the student perspective of instructors' pedagogy in introductory versus upper-level courses and in STEM versus non-STEM courses. In "Talking about Leaving Revisited: Persistence, Relocation, and Loss in Undergraduate STEM Education," A. Hunter, E. Seymour, T. Weston, et al, cited a number of reasons as to why students switch from STEM, including but not limited to: competitive, unsupportive STEM culture; confidence loss and discouragement resulting from low grades early on; poor quality STEM teaching; ineffective curricular designs; and conceptual difficulties with one or more STEM subject(s). We observed that the common denominator of these reasons for switching are the dynamics of the classroom. Therefore, understanding the disconnect between instructors' well intended pedagogical practices and the way students actually experience them, is of critical importance. The next step in our research is to conduct focus groups, interviews and/or surveys to gather data that will then be analyzed. One data science method we will use for analysis is linear regression, allowing us to model the relationship between a response variable and one or more predictors by fitting a linear equation to observed data. The regression will be executed in R, a programming language used for statistical analysis. By modeling the relationship between classroom practices and their impact on the student, our methodology aims to empower student voices and equip future pedagogical work to be better catered to the learner. We hope that with more effective pedagogy, retainment in STEM would be improved for all students.

We thank the Robert J. Stransky Foundation Research Fellowship in the Sciences for financial support.

Poster 52

Diving Into Due Process: Does the Right to Privacy Preclude State Regulations of Contraception?

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Moot Court Team, College of the Holy Cross

Every May, the American Moot Court Association releases the mock brief used in the upcoming fall competition season. The hypothetical case this year addresses the question of whether the right to privacy is found within the Constitution and if this right includes a right to contraception in the fictitious state of Olympus. Furthermore, I examined whether the landmark cases of *Griswold v Connecticut* and *Eisenstadt v Baird* should be overturned and if the law surrounding them should be changed. The 14th Amendment's Due Process Clause sits at the center of my argument, as it prohibits states from impeding on any person's "life, liberty, or property, without due process of law." Using this textual basis, I have gathered evidence to both defend and attack the idea of a constitutional right to privacy that protects the use of birth control. The Petitioner, the state of Olympus, possesses a more substantial legal foundation, limiting the constitutional right to privacy and deeming contraception a matter that should be left to the states' discretion. However, the Respondent, a private party, has a much stronger moral argument, namely that personal autonomy in a free society should remain paramount. While I must be fully prepared to argue both the side of Petitioner and Respondent in a manner consistent with the competition's rules, personally I conclude that the Respondent ought to prevail. This is because I believe that the protection of bodily choice and the privacy surrounding it is implied within the constitution and should therefore be protected from the federal and state government alike.

We thank the Weiss Summer Research Program for the financial support.

Poster 53

Can Transpyloric feeds play a role in the management of infants with Severe Bronchopulmonary Dysplasia (sBPD)?

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With the improvement in prenatal care such as antenatal steroids, improved surfactants, newer modes of ventilation, younger and smaller infants are surviving. These infants have very immature lungs due to Surfactant deficiency called respiratory distress syndrome (RDS) and are at a very high risk to develop severe chronic lung disease called severe Bronchopulmonary Dysplasia (sBPD). They are at higher risk for lethal pulmonary hypertension (PPHN), needing positive pressure support for breathing, assistance for feeding and a prolonged stay in the hospital. Various strategies have been used to treat sBPD and to wean these infants off the positive pressure, such as diuretics, steroids and the use of micro-aspiration reducing strategies such as Transpyloric feeds (TP). This is a retrospective study of ELBW (<1000 gm) infants with BPD at 36 wk corrected age who were managed with or without TP feeds at the CCMC NICU. The specific aim of the study was to evaluate the association of TP and PPHN and the factors that may affect this association. Data was gathered from the EPIC and NIS databases. We gathered demographics, morbidities associated with sBPD, details of TP feeds, medications and length of stay. We used the SPSS software of R-statistical package to make univariate (X^2 Test) and multivariate (multiple logistic regression) comparisons. The results found the study population was sicker and smaller compared to control ($p < 0.05$). PPHN and G-tube incidence was not significantly higher in the study population ($p > 0.05$). TP feeds were not associated with increased incidence of PPHN or needing G-tubes despite being used in the sickest babies with sBPD and should be considered as a treatment option for sBPD.

I thank the Connecticut Children's Medical Center, Department of Pediatrics for making this internship happen.

Poster 54

Household Impact of Nursing Home Closures

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“Trade-Offs in Intergenerational Family Care Provision” has illuminated how shifts in elderly care can affect the childcare provided by grandparents and influence fertility rates. The recent surge in nursing home closures is a significant concern, with implications that extend far beyond the elderly and their families to encompass broader labor market dynamics and societal structures. The closing of nursing homes leads to employment decline in the health sector in rural areas. Here, we sought to explore whether nursing home closures are driving an increase in informal family care for the elderly and what the subsequent effects might be on households, specifically focusing on changes in female labor force participation and fertility. Our research aimed to unpack the intricate connections between these closures and familial care dynamics, adjustments in employment patterns, and intergenerational behavioral changes. We used a two-way fixed effects regression model ($Y_{c,t} = \beta_0 + \beta_1 \text{closure}_{c,t} + \beta_2 \ln(\text{population}) + \gamma_t + \sigma_c + \epsilon_{c,t}$) utilizing the number of total beds counts and the determination dates of the nursing homes to identify closures. Through a series of carefully conducted regression analyses across different scopes and frequencies of data collection, our preliminary findings have revealed a negative and significant relationship between the closure of a nursing home in a state and year and the amount of informal care provided by individuals. This might suggest that as the nursing homes close, the elderly move to other facilities so that their families are spending less time with them. However, this initial insight is tempered by the fact that we have not yet completed the process of validating our data’s credibility and precision. To refine our understanding, further research will be necessary, particularly focusing on differentiating between urban and rural counties and exploring the underlying reasoning behind the observed regression results. By doing so, we hope to provide a more comprehensive picture of the complex and multifaceted impacts that nursing home closures can have on families and broader societal dynamics.

We thank the Weiss Summer Research for funding this work.

Poster 55

Functional Communities in EEG Data from a Face Recognition Task

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The brain is a complex system with interconnected regions that communicate and interact to perform various cognitive functions. Network analysis provides a framework to study these interactions by representing the brain's regions as nodes and their connections as edges in a graph. In our research, we are interested in detecting functional communities and analyzing their variation across different conditions, subjects, and frequency bands. We utilized a publicly accessible dataset sourced from OpenNeuro. This dataset encompasses EEG, MEG, and MRI data obtained from 16 healthy adults engaged in a simple task while viewing images of familiar faces, unfamiliar faces, and scrambled face stimuli. While our project primarily centers on EEG data analysis, the methodologies and insights could potentially extend to encompass MEG and even MRI data. In this project, we use the debiased weighted Phase Lag Index (dwPLI) to detect the coordination among signals received by EEG electrodes. We have completed the first part of this project, which is to identify the functional communities across all participants and conditions for the alpha-beta frequency band.

We thank Dr. Dan Kennedy '68 for his generous financial support.

Poster 56

A hedonic analysis of offshore wind turbines: does distance matter?

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Block Island, Rhode Island is home to the United States' first operational offshore wind farm. The Block Island Wind Farm (BIWF) contains five turbines and is located about 3.8 miles from the shore of Block Island. Construction of the wind farm, developed by Rhode Island-based Deepwater Wind, was completed in late 2016, and since May 2017, Block Island has been completely powered by wind energy. While offshore wind certainly has substantial environmental benefits, its social and economic impacts may not be consistently positive. Block Island is a popular tourist destination, and the visual impact of these wind turbines may affect tourism, utility, or buyers' willingness to pay for homes. This study examines the effect of the BIWF on house prices using a hedonic pricing model and a difference-in-differences approach. Our treated group consists of properties on Block Island that have a view of the BIWF. Our control group is made up of properties on Block Island without views of the BIWF, along with properties on Martha's Vineyard and Nantucket, which are also tourist destinations with similar housing price trends prior to the construction of the BIWF. We use data from the Zillow Transaction and Assessment Dataset (ZTRAX), which includes data on housing transactions from 2000-2020. Our regressions include various controls for property characteristics such as lot size, age of the house, and number of bedrooms. We also include month and year fixed effects. We find a consistently negative effect of a view of the BIWF on house prices, which is statistically significant across some specifications. These results have important implications for renewable energy policy, as they suggest that offshore wind farms located in close proximity to the shore may have negative impacts on local economies and housing markets, and that distance likely matters in terms of siting offshore wind developments.

We thank the Dr. Charles Weiss Summer Research Program in Economics for financial support.

Poster 57

Synthesis of N-Tosyl-4-Imino-4H-Pyrido[1,2- α]Pyrimidine through Copper-catalyzed azide-alkyne cycloaddition (CuAAC)

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Pyrido[1,2- α]pyrimidines have anti-cancer properties, anti-allergic properties, and are used in metabolic disorder treatments and gene expression regulation. There are a limited number of methods in the literature to synthesize this important heterocycle. Our research group has explored an efficient synthesis of pyrido[1,2- α]pyrimidines utilizing copper-catalyzed azide-alkyne cycloaddition (CuAAC) in a two-step approach. The first step is based on a well-established substitution reaction to generate 2-amino-pyridines. Our research this summer focused on the optimization of the key step - the copper-catalyzed, intramolecular, one-pot reaction. A singular copper catalyst, $\text{Cu}[\text{CH}_3\text{CN}]_4\text{PF}_6$, was explored under reflux conditions in an attempt to replicate a previous trial. We hope to optimize this reaction through the exploration of various bases, catalysts, and solvents.

I would like to thank the John Flavan '53 Bequest for sponsoring this research.

Poster 58

Attentional sensitivity: How it's done in Pigeons

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It may seem as if humans are the only animals capable of tasks like predicting another person's behavior; however, other animals may be capable of these complex behaviors as well. When presented with a human actor reaching towards either a target to the right or a target to the left, human observers were able to predict the direction the actor was reaching towards. The actors' reaches were either directed or chosen freely, and the participants responded more quickly when the actors freely chose. We presented the pigeons with the same videos of the humans reaching, and trained them to make choices accordingly. This investigation can highlight the differences in the mechanisms of attentional sensitivity across species.

We thank the Weiss Summer Research program for financial support.

Poster 59

Language Barriers and Autism Spectrum Disorder: Examining the Impact of Limited English Proficiency on Diagnosis, Access to Services, and Therapeutic Outcomes in Children

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Access to quality medicine is only sometimes a guarantee for disadvantaged families. The first step in getting quality care and service is being able to understand the service you are receiving and being able to communicate with the provider. With this internship, we investigated the multifaceted relationship between language barriers, autism spectrum disorder (ASD), and limited English proficiency (LEP) in pediatrics populations. Children with ASD and have parent/guardian with LEP face distinct challenges that can hinder accurate diagnosis, impede access to essential services, and potentially compromise therapeutic outcomes. Through a comprehensive review of literature and empirical research, we explored how language barriers contribute to the misunderstanding of complex terms for treatments for those with ASD. Other difficulties encountered are the difficulty to access appropriate interventions and support services due to communication limitations. Understanding the intricate interplay between language barriers and ASD is crucial for informed clinical practice, policy development, and the creation of tailored interventions that address the unique needs of children with ASD and limited English proficiency.

We thank the Summer UMass Med Internship Trial (SUMMIT) program of the Department of Pediatrics at UMass Chan Medical School for making this internship possible.

Poster 60

Reframing the Free Market Fight: How Financial Products are Held to a Different Regulatory Standard

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Over the past several decades, the U.S. government has significantly increased consumer protections on appliances, food, and skincare products, while consumer financial products remain relatively untouched by government authority, despite their well-documented harmful effects. We sought to understand why financial products are held to a much lower regulatory standard than other consumer goods. To conduct this study, we analyzed the previous work of political scientists, and contributed to their current body of research. We saw that there is a current policy framing issue that considers the regulation of financial products to be antithetical to a healthy free market. This framing issue is rooted in the fact that the consumer-driven economy that exists today has been built upon widened access to consumer credit since the post-depression era. Policymakers use this framing to justify limiting the regulation of financial products to only information disclosures, which have become more obfuscating than revealing to financially illiterate buyers. We determined that there is a severe and purposeful asymmetry of information between the buyers and sellers of financial products that both leaves consumers much more vulnerable to purchasing harmful financial products than other harmful goods and also increases systemic risks in the financial sector of the economy. It is therefore necessary to reframe the policy debate around consumer financial protection regulation in order to ensure a well-functioning financial sector as well as to reduce the harmful effects of deceptive financial products on the American consumer.

We thank the Weiss Research Program for financial support.

Poster 61

Pulsed Charge Transfer Equipment Testing and Ion Time of Flight Measurements

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Measuring charge transfer collisions between lithium atoms and protons is relevant to ongoing nuclear fusion research. In the past, our lab has measured the cross-section of these charge transfer collisions at energies as low as 130 eV; however, we would like to reach energies closer to 10 eV in order to better mimic the collisions occurring in nuclear fusion reactors. This requires alterations to be made in the experimental method, which uses an electric field to sweep Li^+ ions produced in collisions between a beam of lithium atoms and a continuous beam of protons into a detector. The new method involves pulsing the proton beam and electric field on and off, exactly out of phase of one another. Actualizing this requires seven precisely coordinated voltage pulses, which will be applied to specific experimental equipment. These pulses are produced by two pulse generators that are remotely controlled using a computer program called LabView to an accuracy of a few tens of nanoseconds. New experimental hardware, including a new Li^+ detector (CEM), a device that measures the number of incoming protons, deflection plates to turn the proton beam on and off, and a metal ring to prevent Li^+ from leaving the collision site, has been installed. A variety of experimental tests confirmed that the new hardware is functioning properly. The new hardware was used to identify background ions present in the experimental apparatus, knowledge of which is important for optimizing the lithium collision experiments. The technique involves pulsing the proton beam on briefly, then quickly applying the electric field pulses and measuring the times when background ions reach the CEM. Using LabView, we created a program that would automatically apply these pulses and record this data. The data was then cross-checked with theoretical results based on simulations using the computer program SIMION, confirming the presence of water, argon, and hydrogen background ions.

We thank Marion and Samuel E. Krug, Ph.D. '65 for their generous financial support and Dick Miller for machining expertise that made this research possible.

Poster 62

A Novel Psychological-Behavioral Intervention to Promote Physical Activity in Type 2 Diabetes

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Of the 30 million Americans living with type 2 diabetes (T2D), greater than 75% are at high risk for adverse medical outcomes due to failing to meet guidelines for physical activity, a critical health behavior for those with T2D. Motivational interviewing (MI), an established approach to behavior change, is one potential intervention strategy for increasing physical activity but previously has resulted in modest effects on increasing physical activity when used alone. Positive psychology (PP) interventions develop skills to increase positive emotions and may be more successful in both promoting physical activity and improving health outcomes. We are evaluating the efficacy of an 8-week, phone-based, integrated PP-MI intervention to promote physical activity in 280 adults with T2D and low physical activity. Study participants first complete two baseline study visits and are randomly assigned to the PP-MI or MI-alone condition. Participants then complete 8 weeks of weekly phone calls with a study interventionist where they engage in PP-MI or MI-only activities and discuss their progress on achieving physical activity goals. Follow-up study visits are conducted at 8-, 16-, 24-, and 52 weeks post-randomization. The primary study outcome measure is the amount of time spent performing moderate to vigorous physical activity (MVPA; measured by accelerometer). Psychological, functional/behavioral, and health-related outcomes are also assessed. Recruitment began in October 2022 and is ongoing; we hypothesize that the integrated PP-MI intervention will significantly increase MVPA and improve health outcomes compared to MI-alone.

This research was funded in part by grants R01DK113185, 1UL1TR001102, and 1UL1TR002541-01.

Poster 63

Stereotactic Intracerebral Hemorrhage Underwater Blood Aspiration (SCUBA) Technique for Minimally Invasive Endoscopic Intracerebral Hemorrhage Evacuation

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Spontaneous intracerebral hemorrhages (ICH) account for 15-20% of all strokes and remain the most devastating form with a mortality rate of approximately 40%. Of survivors, only 20% are functionally independent at six months post stroke. Despite recent clinical trials investigating new approaches to medical and surgical ICH treatment, there is currently no treatment with any proven functional benefit. The Stereotactic Intracerebral Hemorrhage Underwater Blood Aspiration (SCUBA) technique has been developed to perform minimally invasive endoscopic ICH evacuation. The SCUBA technique is unique in that it combines two different neuroendoscopic strategies in two phases, one under dry-field conditions and a second under wet-field conditions. This technique allows for clear visualization of residual clot burden, as well as cauterization of active arterial bleeding. SCUBA has improved efficiency of hematoma evacuation particularly in patients with deep ICH in the basal ganglia. Our study is a single center, retrospective pilot study to evaluate the SCUBA technique and its potential to improve functional outcomes of severe ICH patients. The study includes patients who underwent endoscopic ICH evacuation with the SCUBA technique at Hartford Hospital from 2019 to 2022. Our preliminary results from these patients indicate that the SCUBA technique can efficiently and safely evacuate hematoma in deep basal ganglia. Our next steps include matching each SCUBA patient with a control patient who received only standard medical treatment for ICH. From there, we will compare functional outcomes between the two groups with focus on mRS at 3 months post ICH along with NIH Stroke Score, length of neuroICU stay, length of hospital stay, and discharge disposition. Analysis will then be performed to test the hypothesis that patients managed with SCUBA will have better clinical and functional outcomes.

We thank the Hartford Hospital Pre-Med and Research Program and Hartford Healthcare for financial support.

Poster 64

Social Cognition:

Pigeons Determining Friends from Neighbors in Photos

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Humans are social animals capable of recognizing others (like friends and neighbors) through photographs, as evident in social media. Recognizing the correspondence of 2D representation of people to their real selves is a complex visual-cognitive ability. Pigeons are highly visual, social animals who can recognize whether another pigeon is familiar or not. We examined whether pigeons can discriminate photographs of “friends,” with whom they regularly interact with physically, from “neighbors,” who live in the same space. The pigeons were trained to peck at “friend” images for food reinforcement in a go/no-go task. Analyzing the discrimination ratio, pigeons can learn to discriminate between “friends” and “neighbors” images. Then, the pigeons were presented non-reinforced new images to evaluate memorization, which were afterward added to their training repertoire. Various angles impacted pigeons’ performance as the discrimination ratio difference between perspective types critically revealed the pigeons’ reliance on similarity to trained instances. Pigeons may utilize multiple factors to differentiate between pigeons which impacted their recognition of other pigeons in images.

We thank the Dr. and Mrs. Anthony M. Marlon ‘63 Summer Research Fellowship for financial support.

Poster 65

Journeys Through the Racial Citadel: Analyzing Folklore and Racial Narratives within *Dungeons & Dragons* and Other Tabletop Role-Playing Games

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Racial and ethnic identity can be understood in many ways for various generational and geographical groups. *Dungeons & Dragons* 5th Ed., the popular tabletop role-playing game, provides an opportunity to explore identity as players are given the chance to play as a character with a “race” that is not their own. Tabletop role-playing games fit into a “pen-and-paper” genre of board games; the objective is to play out a story through improvisation and collaboration. Each system is different, but all share one major commonality: the rolling of dice to determine elements of the world. These games, which can range from high fantasy to modern realism, allow players to create a character whose limits are bound only by one’s imagination. A group of players creates a party, where each character brings something unique and each must work for and with others. With this project, I have delved into the folklore represented within *Journeys Through the Radiant Citadel*, a *Dungeons & Dragons* campaign anthology book. *Citadel* was written by a team of 15 creators of color tasked with bringing their lived experience, cultural folklore, and family history into a world of fantasy, adventure, mischief, mystery, and more. My focus has been on each adventure’s connection to the mythological and folkloric counterparts it was based in and how to approach these synchronicities as a player. Many of the writers involved called upon stories from their childhood, such as the ghost stories of Northern Mexico, while others drew upon traditions and festivities integral to their culture, such as Thai night markets. Adventures in the anthology shared common themes of family, social polarity, the role of an outsider, and a celebration of culture and customs. I have also explored how the concept of race has been approached through various tabletop systems, such as earlier editions (3.5) of *Dungeons & Dragons* (race), *Star Wars: The Roleplaying Game* (species), and *Pathfinder 2e* (ancestry).

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Poster 66

The Impact of Requiring Broader Female Representation on Boards: Evidence from California

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On September 30, 2018, former California Governor, Jerry Brown, signed into law Senate Bill 826. The law required all publicly traded firms headquartered in California to abide by new gender quota standards for their respective board of directors. Governor Brown and the California legislature had hoped to accelerate the inclusion of women in the corporate world. Following the law's passage, firms were required to have at least one female on their board by EOY 2019, and a proportional amount depending on their board's size by EOY 2022. This meant that firms with sizes of 4, 5, and 6+ members needed at least 1, 2, or 3 females respectively. 98% of California firms complied with the 2019 mandate, and 75% complied with the 2021 mandate. Previous research has primarily focused on the law's impact on stock returns and the qualifications of the new female board members. However, research has overlooked *how* California firms complied with the law. As there were many options available to companies to become compliant, did these companies choose an option that gave women substantial voting power on the board, or did they choose an option that gave women the least power possible? To better understand how companies responded to the law, we analyze what factors are related to both whether companies chose to comply with the law and how they chose to comply. The factors we consider are the type of industry, firm size, women on the board pre-law, quota gap, size of the board, and a female supply constraint measure. Additionally, in May 2022, the California Supreme Court invalidated the law due to California's equal protection clause. This development will allow us to study whether firms continued to employ female directors or reverted their board demographics to pre-law levels.

We thank the Weiss Summer Research Program for funding this work.

Poster 67

Review of Business, Ethics, and Society Minor

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Business is one of the dominant institutions in contemporary society. We rely on it as a primary source of goods, services, employment, opportunity, wealth, security, and prosperity. With that, the institution of business has increasingly become a determining factor in who lives a good life and who doesn't. The Holy Cross Minor in Ethics, Society, and the Institution of Business (ESIB), formally Business, Ethics, and Society (BES) invites Holy Cross students to explore these ideas of business. Through its self-designed curriculum, internship requirements, and capstone project, the minor asks students to draw out their own conclusions on the role of business, and how it can improve in our modern society. Since the minor's inaugural year, the College has welcomed 38 students across two graduating cohorts of 2022 and 2023. As with any new minor, the program heavily relies on student feedback to assess outcomes and improve the program. Students completing the minor find benefit from taking classes outside of their major and common requirements, appreciate the different perspectives gained, note the program is a major point of discussion in job interviews and the capstone is a perfect project for a liberal arts college. Significant work still needs to be done to address the perception of the minor on campus. This includes promoting the minor to students earlier in their academic career and engaging with faculty and the College community by offering regular programming.

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Poster 68

What Makes Sports Gambling a Good Bet? The Determinants of State Sports Betting Revenues

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Following the 2018 Supreme Court decision, striking down the federal ban on state authorization of sports betting, the legalization of sports betting has fallen on the states, being legalized in 37 states as of 2023. While sports betting might be legal in many states, it varies significantly state by state. During the legalization process, states decide their own tax rate, whether they will allow major operators and online gambling as well as many other factors. With states like New Jersey gambling almost 20 times as much as its neighbor Delaware, it is important to understand what drives these interstate differences. To investigate this we ran regressions using an unbalanced panel with 28 states. We find the presence of online operators has a concave impact on sports betting, higher tax rates correlate to larger levels of sports betting, and the hold of the operator, which is a measure of profitability, has a negative impact on sports betting. Finally, the presence of Power 5 colleges has a positive effect, though the presence of professional sports teams gives an opposite result. We do not have consistent results for the age distribution variables, income, and the presence of the major operators (FanDuel, BetMGM, and DraftKings) in a state. As gambling markets continue to operate and states change their gambling laws, there will be opportunities to conduct more research and increase the understanding of gambling determinants.

We thank the Weiss Summer Research Program for funding this work.

Poster 69

Impact of Cholesterol and SGK1 on T-cell Function

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Cholesterol metabolism has been found to be dysregulated in several neurological disorders including Alzheimer's disease, Huntington's disease, status epilepticus, etc, resulting in cholesterol accumulation in the brain. Inflammation was also frequently described in patients with these diseases. However, there was no clear demonstration of a relationship between cholesterol and inflammation. Here, we studied whether there is a link between cholesterol and T-cell related inflammation and if so, by which mechanism. SGK1 (Serum and glucocorticoid-induced kinase 1) has previously been reported to be modulated by cholesterol and able to induce Th17 cell development. In this study, we investigated the impact of cholesterol and SGK1 on Th1-cells. Blood samples were obtained from healthy donors (n=4) and memory CD4⁺ T-cells were isolated using negative immunomagnetic selection from peripheral blood mononuclear cells. Isolated cells were then stained for CXCR3 to collect only CXCR3⁺ cells after Fluorescence Activated Cell Sorting. CXCR3⁺ cells were cultured during 12h or 48h, with or without cholesterol, in the presence or absence of SGK1 activator (NaCl 80 mM) or SGK1 inhibitor (GSK650394 1 μ M). To measure cytokine production, a part of the cells was stimulated in culture with CD3/CD28 beads for 48 hours. Gene expression was measured using qPCR (SGK1, IFNG, FOSB, JUNB) and cytokine concentrations by ELISA (IFNG). We found that cholesterol significantly upregulated IFNG ($p < 0.01$), SGK1 ($p < 0.001$), FOSB ($p < 0.001$), and JUNB ($p < 0.01$) expression at 12h. SGK1 inhibition reduced IFNG and FOSB, but not JUNB expression. No difference was found in cytokine production neither in the cholesterol condition nor with the SGK1 activator/inhibitor. This data suggests the cholesterol accumulation may increase IFNG and FOSB expression, through SGK1 modulation. This provides new insight into the mechanisms by which cholesterol can dysregulate many genes highlighted in Th1-cell function.

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Poster 70

The Applicability of Justice Jackson's Opinion in *Youngstown*

Sheet & Tube Company v. Sawyer

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During the Korean War, President Harry Truman issued an executive order to seize most of the United States' steel mills, fearing a steel shortage during a labor dispute would threaten national security. Although Truman immediately sought Congress's authorization, the legislature did not take any action. When the steel companies appealed his order, Congress's inaction required Truman to rely on his implied powers as President. As a result, the Supreme Court held that President Truman's executive order was unconstitutional because he was not explicitly authorized by an act of Congress or acting on the specific constitutional authorities provided to the President. Importantly, Justice Robert Jackson in his concurring opinion in the case attempted to create a legal framework to provide a broad solution to any question regarding the extent of presidential authority. This project used legal research methods and close textual analysis to explore Jackson's opinion in this case that outlined presidential authority when Congress was silent. Then, I applied Jackson's framework to a series of subsequent cases. Ultimately this study determined that disputes in domestic politics tended to fit Justice Jackson's framework. However, questions of presidential authority regarding international politics, such as treaties, either stretched Justice Jackson's framework or the Court did not apply it at all. In the broadest sense, the Supreme Court case of *Youngstown Sheet & Tube Company v. Sawyer* and the context surrounding the decision exemplify important lessons about the intersection of law and politics.

We thank the Weiss Summer Research Program for financial support.

Poster 71

“Science: The Endless Frontier”, Networks, and Committees: An Analysis of post-WWII Science Policy Formation in the USA

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How does the scientific community influence American public policy? What are the politics of science? To answer these questions, we first point back to the period between 1945 and 1975, with the emergence of a coherent public philosophy of science and the creation of a government science establishment. More specifically, we trace the networks of scientists through the various agencies that were formed during this time, to demonstrate that ideas matter in politics, and that interpersonal relationships are an important means by which ideas are transmitted. To quote Professor Klinghard, “This is partly a story of ideas—that is, how influential ideas shape politics. But it is also a story about people—in particular, how particular scientists working in government spread ideas.” In this endeavor we take Vannevar Bush's seminal 1945 report, *Science: The Endless Frontier* as a starting place. This document, composed by staff of the National Defense Research Committee (NDRC) and the Office of Scientific Research and Development (OSRD), was immediately designed to shape debate over the creation of the National Science Foundation (NSF), but was also part of a broader debate over the role of science in postwar America. We found that certain scientists established networks designed to support these same goals. In this postwar period, there was a central body of scientists, who each held membership in science-related committees such as the Office of Technology Assessment, the Atomic Energy Commission, and the National Science Board. The members of this group have a history of supporting the views expressed by Bush and collectively influenced the aforementioned committees to reflect those values. This is why the distinction between a “science for policy” and “policy for science” becomes difficult.

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Poster 72

Uncompromising Confessions of Faith: A Study of Maximus the Confessor, József Cardinal Mindszenty, and Joseph Cardinal Zen

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A confessor is a Christian who suffers persecution for the Christian faith and survives, as distinct from a martyr who dies from persecution. Confessors thus gain a status similar to that of a martyr while remaining as living figures in the Church. Rather than simply renounce their Christian faith explicitly, some confessors are pressured to compromise its integrity in another way. These include Maximus the Confessor (Byzantium, 580-662), József Cardinal Mindszenty (Hungary, 1982-1975), and Joseph Cardinal Zen Ze-Kiun (China, b. 1932). This study was conducted through a close examination of the primary sources relevant to each figure, including Maximus' trial record, Mindszenty's *Memoirs*, and a series of lectures given by Zen. Each of these figures confesses Christ, but in ways that respond particularly to their political circumstances. Maximus confessed an orthodox Christology, positing that Christ possessed two wills, refusing to obey Emperor Constans II's mandate of silence on the divisive subject. Mindszenty, in addition to protesting against religious suppression in Communist Hungary, confessed the social role of Christ and the Church in Christian society, opposing militant political atheism. Zen confesses fidelity to the universal nature of Christ's Church, expressed particularly through formal submission to Rome. He rejects the establishment of a Chinese national Church, subordinate to the Chinese Communist Party. All three figures posit a vision of Church and State in which spiritual power is wielded by Apostolic authority, not subject to empire or democracy. In each case, the confessor gained a role of public influence, revealing to the public the brutality of persecution. The persecutors pressured the confessor to compromise, framing him as a rigid source of disharmony. These compromises, however, would violate what was, according to the confessor's conscience, essential to his confession of Christ.

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Poster 73

Understanding the Challenges Faced by Women of Color on PWI Campuses and The Supportive Role of ProspHER

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Participation of women of color has increased in higher education from 17.4 percent in the 1980s to 47.9 percent in 2021 (NCES, 2022). Despite the increase, significant challenges still face women of color while in higher education, especially at predominantly white institutions (PWIs). Throughout their undergraduate education, women of color experience unique challenges such as microaggressions, isolation, and psychological stressors due to discrimination that can impact their mental health, academic success, and sense of belonging. Relatedly, retention issues are also prevalent among women of color in higher education. For instance, in 2014 the graduation rates within four years after entry were 56.3 percent for White female students and 31.8 percent for Black female students. Sanford (1962) introduces the concept of challenge and support—that is, as a student faces cognitive dissonance resulting from exposure to challenging stimuli, it is crucial to support the student in the process of assimilating new ways of thinking. Hence, our research was motivated by ProspHer, a student organization at the College of the Holy Cross that supports self-identified womxn of marginalized identities and aims to address the challenges they can encounter at PWIs. Through our research, we examined existing literature about how to support and uplift undergraduate womxn of color. In addition to reviewing the literature, interviews were conducted with professionals at other selective PWIs to learn more about best practices and models that could be incorporated at the College of the Holy Cross and within ProspHer. Findings point towards the necessity of an organization like ProspHer to aid womxn of color to overcome their challenges and navigate an environment that wasn't originally designed to meet their needs.

We thank the Weiss Summer Research Program for financial support.

Poster 74

An FDA Approved TrkB Antagonist Inhibits Seizures in a Mouse Model of Status Epilepticus

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Temporal Lobe Epilepsy (TLE) is one of the most common and often devastating neurological disorders of humans. One cause for TLE is Status Epilepticus (SE), a condition characterized by an episode of prolonged seizures. BDNF/TrkB signaling is implicated in development of TLE. We previously demonstrated that inhibition of TrkB kinase inhibits prolonged seizures in SE. We first found that oral administration of a Trk antagonist to adult mice inhibits TrkB in brain regions critical to the pathophysiology of TLE. Therefore, we asked whether pretreatment with a Trk antagonist suppresses seizures. LOXO-101 (Larotrectinib) is a small molecule that selectively inhibits Trk(A, B, and C) and has been FDA approved for treating patients with Trk fusion-positive cancers. We hypothesized that LOXO would inhibit SE in mice. SE was induced by infusion of kainic acid, a chemoconvulsant, into mouse amygdala. Mice were fasted overnight and received either LOXO or Vehicle (PBS) at a dose of 1 μ L/g via oral gavage 30 minutes prior to KA delivery. Mice underwent uninterrupted SE for 2 hours before termination via intraperitoneal diazepam and lorazepam injections. Seizures were monitored by video-EEG recording and analyzed by two blinded investigators. There was a non-significant higher latency to EEG seizure in the LOXO group compared to the vehicle group. Latency to first convulsant (class 3) seizure was significantly higher in the LOXO group compared to the vehicle group. There was no difference in total duration of EEG seizures during SE between groups. LOXO may prevent seizure propagation to the motor cortex. In sum, our results demonstrated that inhibition of Trk kinase with LOXO-101 inhibits seizures in a mouse model of SE. Further investigation on the seizure prevention effects of LOXO in other models of SE is warranted.

We thank the NINDS for financial support.

Poster 75

Silly Shapes:

Testing the boundaries of pre-attentive visual search

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Past studies of attention and visual processing of novel stimuli during visual search have constrained pre-attentive nonconscious processing as negligible; a rudimentary precursor capable of analyzing only one feature. We wanted to determine if the nonconscious system can identify and direct attention to a potential target defined by multiple characteristics. Therefore, we conducted a task with 17 College students to determine whether a previously defined target shape was present within a field containing several unique distracters. Distractors differed from the target shape, sharing none of the five defined features with the target (0D), one of the features with the target (1D), or two of the features with the target (2D). Eye movements and pupil diameter were monitored during the visual search task. Main findings showed that, during trials in which the target was present with both 1D and 2D distractors, participants were significantly more likely to fixate first on the target shape than the 1D or 2D distractor shapes. Additionally, in the less likely chance that participants did not fixate on the target, the participants were more likely to fixate first on the 2D shape than the 1D shape. The number of first fixations decreased significantly from Target, to 2D, to 1D. These results may suggest that non-conscious processing can bind more than one feature together, debunking the idea that nonconscious processing is simply a crude predecessor to our visual conscious system. Moreover, additional planned studies will indicate that we may possess a non-conscious visual system that can localize a target shape and discriminate between shapes that share multiple target features within a visual search task.

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Poster 76

The Allocation of Transportation and Infrastructure Spending in Congress: Which Members Receive the Most for Their District?

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In November 2021, the Investment in Infrastructure and Jobs Act (IIJA) was signed into law by President Biden, with the intention of revolutionizing American Infrastructure. It was the largest federal investment in infrastructure nationally since The New Deal. In this research, I look into how infrastructure and transportation investments were allocated in the 117th Congress (2021-2023), before and after the IIJA became law. Beyond large investment bills, such as the IIJA, infrastructure and transportation spending typically come from annual appropriations packages, FEMA spending post-emergency (not included in this research), investment from a bureaucratic organization, such as the Department of Transportation, US Army Corps of Engineer projects, and federal earmarks. Banned until the beginning of 117th Congress, there is now a formalized procedure for requesting earmarks for projects in a member's district; earmarks have been renamed to Community Project Funding (CPF) in US House and Congressionally Directed Spending in the Senate. This change has caused more transportation and infrastructure projects to receive funding. Given the close constituent connection in the House of Representatives, I created a dataset by analyzing every member's press releases and newsletters for an announcement that their district would be the recipient of a grant/funding. We chose this method because a member has no incentive and gains no advantage by not publicizing funding. I then compared the number of projects from each individual member against variables that could possibly impact their likelihood to receive and publicize federal funding, including committee assignment, ideological score, electoral numbers, district demographics, and years of experience. The findings showed that the level of funding received by a member varied as a function of some of the variables I examined. These will be discussed in more detail.

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Manufacturing Reproducibility of a Dual Prevention Vaginal Film for HIV Prevention and Contraception

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Women are a biologically susceptible high-risk group when it comes to HIV acquisition. The Eastern and Southern regions of Africa remain the most heavily burdened by HIVs, with women accounting for 63% of new HIV infections. This creates a need for new prevention modalities specific for women. There is an additional need in Africa to increase access to contraceptive products. This combined with an expressed desire from women for products which provide dual protection from HIV infection and unintended pregnancy make development of a discrete, female-controlled, cost-effective dual HIV prevention and contraception product an unmet need. The Rohan Lab has been working to develop a dual prevention vaginal film that contains the non-nucleoside reverse transcriptase inhibitor, dapivirine, for HIV prevention, and the progesterone hormonal contraceptive agent, levonorgestrel. Although a prototype film has been developed it is critical to establish the reproducibility of film manufacturability to ensure consistency in drug delivery and product usability. Towards that end, various manufacturing runs of the same film formulation were conducted, and films generated were fully characterized. Significant differences in water content was found between batches of films. Additionally, we found that these differences in water content correlated to differences in some mechanical properties of the films, such as tensile strength. These results suggest that 1) differences in the water content could affect film mechanical properties and 2) it is critical to control film water content to ensure product reproducibility. Environmental humidity can play a role in final film water content. For this reason, it is important to investigate ways to control humidity during manufacturing. Product hygroscopy should also be evaluated.

We thank the Magee Women's Research Institute and Dr. Lisa Rohan and her lab for their support this summer. This work was made possible in part by the generous support of the U.S. President's Emergency Plan for AIDS Relief (PEPFAR) through the United States Agency for International Development (USAID) under the MATRIX program.

Poster 78

Towards better understanding of light frequencies emitted by an extended-cavity diode laser

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One of the primary goals of our research is to better understand extended cavity diode lasers (ECDL), which are used in Prof. Roach's lab to cool rubidium atoms to near absolute zero. In addition to this, ECDL are widely used in atomic physics research because they are perceived to be more "stable" than just a laser chip. To reach our goal, we used a custom built spectrometer to analyze the frequencies (or wavelengths) of light being produced by the ECDL. The spectrometer has laser light coming in that gets sent to a grating. From the grating, different frequencies of light gets redirected at different angles into a central beam splitter which sends the light into a camera. We made three improvements to this spectrometer. For each frequency of light, the spectrometer produces a peak in the spectrum but also a small "side peak", appearing like a false frequency. In an attempt to remove the artifact, we replaced the central beam splitter in the spectrometer. As a second improvement, we adjusted the tilt of the grating in order to have the light coming into the camera more properly on a horizontal plane. Finally, we calibrated the spectrometer in order to know what frequencies of light the laser is producing. In order to understand the ECDL, we created a laser simulation based on a mathematical model from the article: Analysis of the Linewidth of a Grating-Feedback GaAlAs Laser by G. Genty, *et al.* The model accounts for the two optical resonators of the ECDL, one being the laser chip itself and the other resonator being the extended cavity. Some parameters for the simulation are newly determined by studying the laser emission of the semiconductor chip by itself. Looking at our simulation in tandem with the actual results, we find that our simulation needs an additional parameter in order to accurately describe the laser frequencies that are produced by our ECDL. This third parameter would describe the semiconductor gain frequency dependence.

We thank Anne E. and John Kirby Bray '79 P10 for their generous support.

Poster 79

Road Salt Salinization of Freshwater Ecosystems: The Impact on Blackstone Invertebrates

A. Bowler and P.J. Torres

Department of Biology, College of the Holy Cross

Winters in New England call for the proactive usage of road de-icing salts as means to ensure human safety. While these chloride compounds provide protective services for the human population, natural ecosystems are continually put at risk by anthropogenic salinization. Road salt runoff enters freshwater environments, affecting not only individual species of aquatic invertebrates but the delicate balances of community interactions and of the ecosystem as a whole. Previous studies have described the negative impacts of freshwater salinization, including but not limited to decreases in invertebrate density and losses of sensitive species. In our study, we focused on three taxa of freshwater invertebrates collected from streams in the Blackstone watershed. Using the aquatic larval stage of mayflies, midges, and uncased caddisflies, we tested the effects of increasing conductivity, or chloride, levels on their growth, emergence, and mortality. We hypothesized that as salinity levels increased, growth rates would decrease while emergence and mortality would increase. In the lab, we simulated freshwater stream ecosystems in tanks with highly controlled temperature, pH, and dissolved oxygen levels. Testing both low and high conductivities against control tanks revealed increased mortality of invertebrates subjected to the high salinities as well as decreased mean growth rates. The mayflies proved highly sensitive, showing the highest mortality rates, while the results of the chironomid species provided evidence towards our hypothesis. Road salt salinization negatively impacts the aquatic invertebrates of our own Worcester community, evoking our obligation to mitigate the effects of anthropogenic influences on natural ecosystems.

We thank the Weiss Summer Research Program for financial support.

Poster 80

Mechanisms of pigeon detection of abnormalities in CT scans

J. Paul and M. A. Qadri

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Computed tomography (CT) scans of the chest are an ideal modality for evaluating pulmonary lung nodules, which radiologists reportedly detect by searching for a sudden appearance and disappearance across images. Pigeons, a highly visual species with a precise visual system, can also detect these biological irregularities, possibly using different underlying mechanisms. To examine the mechanisms pigeons use in this detection process, we applied random and single frame order effects by manipulating the time characteristics of the CT display. The frame order test disrupts the usual systematic and smooth transitions between moving stimuli up and down a stack into an arbitrary order, thus evaluating the alleged importance of time in the task. The pigeons successfully discriminated the appropriate stimuli despite the presentation alterations. The single frame examinations then presented a single frame of a lower bound nodule (appearance of the nodule), middle image of a nodule (fullest appearance of the nodule), and a 'far out' projection (five sections away from the disappearance of the nodule). Most pigeons continued to discriminate between abnormal and normal stimuli in each condition. Future research could examine pigeons as animal models for the training of future radiologists by emphasizing the features that aid other biological vision systems during lung nodule examination.

We thank the Robert J. Stransky Foundation Research Fellowships in the Sciences for their financial support.

Poster 81

The Free Exercise Clause and *Smith*

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The First Amendment states that “Congress shall make no law respecting an establishment of religion, or prohibiting the free exercise thereof.” We focused primarily on the latter clause, identified as the Free Exercise Clause, because it is at issue in the 2023 American Moot Court Association case problem. The case involves a fictitious state, called Olympus, which banned all forms of temporary birth control except condoms in order to prevent the spread of STIs. Mindy Vo, a resident of Olympus, belongs to a religious group which promotes the use of birth control. Consequently, Ms. Vo claims that the Free Expression Clause protects her use of oral contraceptives. To understand this issue, we studied the relevant United States Supreme Court case law surrounding free exercise claims in order to determine. In the 1990 case of *Employment Division v. Smith*, the Court ruled that no law which is both neutral towards religion and applicable to the general public violates the Free Exercise Clause. Although it is possible to argue that the Olympus law fails the *Smith* test, in our analysis we found that if *Smith* stands as precedent then Olympus would almost certainly prevail. However, recent Supreme Court cases have drawn *Smith* into question. In *Fulton v. Philadelphia*, a 2021 case, the Court avoided addressing *Smith*’s status as precedent but six justices, of whom five are still on the bench, joined separate minority opinions that questioned *Smith*’s reasoning. *Smith* survived primarily because the majority in *Fulton* believed that overturning *Smith* would not have changed the outcome. Because that is not true for our case, the Court would likely overturn *Smith* and institute a new standard. The most prominent alternative to *Smith* is strict scrutiny, an exceptionally difficult standard for the government to meet that could undermine the uniform application of government policy. The Olympus law probably fails strict scrutiny, but would likely prevail under a more nuanced intermediate scrutiny approach.

We thank the Weiss Summer Research Program for financial support.

Poster 82

Working for the New Hampshire Fisher Cats

Shea Meier

New Hampshire Fisher Cats, Manchester, NH

This summer after finishing my freshman year, I was an intern for the New Hampshire Fisher Cats, the Double-A baseball affiliate of the Toronto Blue Jays playing out of Manchester, New Hampshire. Approximately 16 college students and recent graduates were hired to be Ambassadors for the Fisher Cats organization. I was required to volunteer in the office up to twice per week from 9:00 to 5:00 as well as work 3 of out 6 games during their homestands. My office responsibilities included labeling photos for social media posts and promotions, identifying potential sponsorship partners, and receiving and tracking incoming documents and packages for players. One of my favorite duties was called "Street Team". Another ambassador and I would hit the streets of Manchester and the surrounding areas to meet community members to talk about the Fisher Cats. We would hand out free schedules to businesses for display in order to increase brand awareness and fan attendance. In addition to working two days per week in the office, I also worked 3 out of the 6 games during each homestand at Delta Dental Stadium. The game day responsibilities included several rotations, one of which was the box office where I sold tickets to fans and helped them exchange tickets for any rainouts. I handled transactions of team apparel while working in merchandise. Some of the in-game support responsibilities I participated in included updating the manual scoreboard, instructing the lucky guest who threw the first pitch where and when to report, escorting the talent for the national anthem, working with groups who had purchased food and merchandise vouchers and answering questions from any fan who needed assistance during the game. Some incredibly special moments for me included the opportunity to dress as Fungo the mascot for a game, work as the batgirl for the visiting Portland Sea Dogs, and having a speaking part in a commercial shared on social media and shown during home games on the Jumbotron.

I am grateful for my time at the Fisher Cats this summer!

Poster 83

Species Diversity of Mayfly (Ephemeroptera) Nymphs in the Lower Ogeechee River Basin

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Mayflies are an important indicator group of insects due to their sensitivity to biotic and abiotic changes in freshwater systems. The Ogeechee River in Georgia is an unfragmented, sparsely developed river, making it an ideal candidate for mayflies to thrive. Species level identification has never been officially conducted in the Ogeechee or the Georgia Coastal Plain. Field sampling was conducted to get a deeper understanding of the taxonomic diversity of the mayfly species that inhabit this river. Select specimens were reared in the lab to attempt controlled emergence, facilitating the identification of later stages of nymph development. Remaining specimens were stored in ethanol and identified in the lab using light microscopy. Taxonomic keys and a literature review allowed for identification to species level for select specimens. Previously collected samples from 2014 were included and identified to genus level for a community assessment of the river. *Maccaffertium smithae* was the most abundant species in our sampling and the supplemental 2014 samples. This species was previously unidentified in this part of Georgia. Defining characteristics including truncated gills, projections on abdominal terga 7-9, and coloration of abdominal sterna allowed us to identify the species as *M. Smithae*. The number of setae on the maxillary crown did not match the literature data; the count is more similar to that in *M. modestum*. This inconsistency raised questions about the authenticity of the literature since these species are commonly confused due to similarities in patterns. This study identified the need for proper taxonomic revision on the species level for mayflies.

I would like to thank the NSF for financially supporting this research.

Poster 84

Effect of Ambulatory Conditions and Virtual Locomotion Techniques on Distance Estimation and Memory of a Navigated Virtual Reality Environment

A. Morris, M. J. Lesofsky, and A. Rimzhim

Department of Psychology, College of the Holy Cross

The use of virtual reality (VR) has been constantly rising in research and training. VR is useful for conducting behavioral and cognitive studies because it simulates real-life scenarios, providing better ecological validity, and allowing precise design controls to benefit experimental set-ups (Srivastava et al., 2019). In this study, we report results from a pilot study using virtual reality for studying perceptual and cognitive processes. The first IV was ambulatory conditions. Previous research has shown that ambulatory movements help navigation, providing useful information from a navigator's motor, proprioceptive, and vestibular systems (Chrastil & Warren, 2012). We used a *sitting* versus a less ambulatory-restrictive *standing* condition. The second IV was locomotion techniques. We used two levels: *steering* (continuous locomotion) versus *teleporting* (i.e., non-continuous rapid relocation). Steering is closer to real-life experience but causes more motion sickness than teleporting. We used an Oculus Quest 2 Head-Mounted Display (HMD) VR headset and hand controllers, and designed the virtual environment using Oculus3D. The DVs were error in distance estimation (online and offline [based on memory]) and recognition memory. Our results did not reach statistical significance ($p > .05$), which may be due to a smaller sample ($n = 20$), but we found consistent numerical trends. Distance estimation error was higher in sitting than in standing conditions for both online and offline conditions. This error was highest in the sitting X steering condition, while the lowest was in standing X steering. For the recognition task, performance was better in teleporting versus steering conditions, but only when sitting (6% difference; in standing, difference = 2%). These results could be explained in terms of better idiothetic information in standing versus sitting conditions.

We thank the Weiss Summer Research Program for financial support.

Poster 85

Effect of Ambulatory Conditions and Locomotion Techniques on Presence and Motion-Sickness After Navigating a Virtual Reality Environment

M. J. Lesofsky, A. Morris, and A. Rimzhim

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Virtual Reality (VR) is a proliferating technology, with an estimated \$70 billion industry growth by 2024 (IDC, 2024). Although VR is mostly used for entertainment, it is now increasingly used for research, education, and training (e.g., in the military and in medicine). Successfully using VR for training and research entails that VR must generate an optimal degree of *presence*, a subjective psychological state of experiencing the real world through a virtual world. We report results from a VR-based behavioral study examining how different ambulatory and virtual-locomotion techniques affect presence. We also studied the effect of these conditions on another dependent variable, *motion sickness* (MS). MS remains one of the biggest and unique challenges that VR's high degree of immersiveness produces. Our 2 (IV 1: Ambulation: Sitting versus Standing) X 2 (IV 2: Navigation Techniques: Steering versus Teleporting) experimental design tested specific conditions for presence and MS. We designed a mostly outdoor environment using Unity3D. We used the Oculus Quest 2 Head-Mounted Display (HMD) VR headset and hand controllers. We ran 20 participants. Our results show that presence was higher in sitting versus standing and teleporting versus steering conditions. We also found higher presence in teleporting than steering condition, but only when sitting. MS was lower for teleporting than for steering and sitting than for standing. We also found that MS was lower for teleporting than steering condition, but only when standing; it was equally lower for the two conditions when sitting. (All results are at $p < .05$). Overall, our results show that teleporting and sitting conditions produce more presence and less motion sickness than steering and standing conditions. Such results can help improve VR's usability for entertainment purposes as well as research and training.

We thank the William F. McCall, Jr. '55 Summer Research Fund for financial support.

Poster 86

Examining Same/Different Concepts in Pigeons

E. Garcia and M. A. Qadri

Department of Psychology, College of the Holy Cross

Humans use abstract concepts like “same” and “different” regularly in their lives, but the ability of animals to learn and use abstract concepts is understudied. Overall this experiment is looking at pigeons' ability to distinguish different and same concepts. Within the experiment, pigeons are presented with both audio and visual stimuli. Previous studies show how, when each ability was tested separately, pigeons were able to discriminate between same from different sequences of stimuli. In those experiments in order to be rewarded the pigeons must distinguish whether or not both stimuli stay the same or change. Pigeons can distinguish differences in both audio and visual stimuli when presented separately. When these stimuli are presented simultaneously then the pigeon must remember both what they had just heard and saw. The birds need to determine whether the stimuli relationships are the same or different across the two modalities rather than perceiving similarities across stimuli. The birds need to discern whether both are the same, both are different, or one is the same and one is different. Thus, the birds have to apply a same/different abstract concept within and across two different modalities simultaneously. This experiment can help expand the understanding of pigeons' abilities to process stimuli across senses and learn abstract concepts.

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Poster 87

Combinatorial Effects of TF Regulation

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Genes are often regulated by many transcription factors, however predicting the regulatory effect of combinations of TFs is a challenging endeavor. In this study, we test how pairs of TFs regulate promoter activity by designing synthetic promoters regulated by the repressor LacI as well as one of two secondary activator TFs, CpxR and MetR. We then measured the expression of this circuit while varying the concentration of both TFs. We find that compared to the activation of either MetR or CpxR acting alone, when in combination with LacI significantly greater activation is achieved. Using a thermodynamic model of gene regulation, we can predict this enhancement of activation by treating the LacI regulated promoter as an “effective promoter” that is relatively weaker compared to the basal promoter strength. Crucially, the simplification of complex regulatory architecture to straightforward pieces proves to be an important step in the development of generalized models of gene regulation.

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Poster 88

The effect of carbon and temperature on amphibian microbiome assembly and anti-pathogen function

M Fry, P. J. Kearns, and D. C. Woodhams

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The fungus *Batrachochytrium dendrobatidis* (Bd) can cause a lethal skin disease in amphibians, chytridiomycosis, that's led to declines in populations globally. While an amphibian's immune system actively fights this pathogen, bacterial communities modulate this effect, potentially helping prevent mortality. While microbiomes differ among amphibian species and climatic regions, the specific effects of temperature and carbon availability on microbiome communities and anti-pathogen function remain unknown. To address this, I conducted a two-part experiment examining the effect of six temperatures (between 10-30°C) and 12 carbon sources on the anti-pathogen function of two strains of amphibian-associated *Pseudomonas fluorescens* and on the assembly of microbiomes from red-backed salamanders (*Plethodon cinereus*) and American toads (*Anaxyrus americanus*). I found that both temperature and carbon source affected the anti-pathogen function of both *P. fluorescens* strains, with lower temperatures (10/15°C) inducing the strongest anti-Bd function. Furthermore, simple carbon sources (e.g., pyruvate) versus complex (e.g., tryptone) produced the strongest anti-pathogen effect. The assembly of microbiomes was affected by temperature and carbon source; however, community membership diverged based on amphibian species. Results indicate that both carbon and temperature play important roles in microbiome assembly and anti-pathogen function in the amphibian microbiome.

This research was funded in part by NSF REU grant DBI-1950051 to R. Skvirsky

Poster 89

Leaders to Legends: The Lives and Changing Perceptions of Alfred the Great, William Wallace, and Frederick Barbarossa

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Of all the eras of Western history, the Middle Ages is perhaps the most overlooked and forgotten by many modern people. When it does come to the attention of the modern mind, it can seem both foreign and familiar. Yet this distance that the present day has from the Middle Ages allows it to be a useful frame of analysis of the universal qualities of leadership and the creation of history. We have studied the lives and careers of three important Medieval leaders with long lasting legacies in their respective countries. The first is King Alfred of Wessex, an Anglo-Saxon king in 9th century England who united many Anglo-Saxons to combat the Vikings and created the kingdom that would eventually become England. The second is William Wallace, a Scottish rebel leader who rose from obscurity at the turn of the 14th century to lead his people in their fight against the English, eventually dying at their hands. The final leader is Emperor Frederick Barbarossa of the Holy Roman Empire, who had to rule a massive realm in 12th century Central Europe that stretched from Denmark to Rome during a period of intense social and religious upheaval. We studied sources from their time, such as chronicles, charters, and artifacts, along with modern academic scholarship on these historical figures and political leadership. It is evident that good leaders properly understand their role and society, and then use that knowledge to create a coherent and constructive vision that they pragmatically pursue. We also analyzed sources that show how people after the lives of these leaders remembered them, using both elite and popular histories portrayed in writing, art, ceremonies, folktales, and more. In our study, it became evident that good leaders properly understand their role and society, and then use that knowledge to create a coherent and constructive vision that they pragmatically pursue. In addition, the long-lasting legacies of these leaders were nearly completely divorced from the historical reality of their leadership, leading to misconceptions with potentially dangerous consequences.

We thank the Weiss Summer Research Program for financial support.

Poster 90

Road Salinization of Freshwater Ecosystems: Impact on Organic Matter in the Blackstone

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New England's harsh winters relate to the high usage of road de-icing salts. The use of road salts is an environmental issue and is difficult to regulate as human safety is a main concern. Past research has indicated that excessive usage of road salts negatively affects all levels of freshwater ecosystems in New England. I looked at the effects of road salts on organic matter decomposition and respiration in the Blackstone Watershed. I used three species of leaves, specifically maple, oak, and birch found in the Blackstone watershed to assess both parameters. A lab mesocosm experiment containing different levels of road de-icing salts was used to determine the effect of varying levels of salt. We hypothesized that there would be a decrease in respiration and decomposition rates as we increased the levels of road deicing salts on our model ecosystems. This study found that maple leaves decomposed at the highest rates and increased decomposition in higher salinity treatments. Birch and oak leaves showed little change in terms of decomposition across salinity treatments. Rates of respiration did decrease in salinity treatments for birch leaf species but not for oak or maple leaf species. The damage being done to the ecosystem in terms of respiration and decomposition is a clear indicator of the effect road salts are having on microorganisms and fungi present in affected freshwater sites such as the Blackstone River.

We thank the Summer Weiss Research Program for their financial support.

Poster 91

The Intersection of Gender and Political Leadership: An Analysis of Yulia Tymoshenko's Media Portrayal in the U.S

V. Lutsyshen, C. Hooper, and S. Yuhl

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This study investigates how gender stereotypes have shaped public perception and media representation of Yulia Tymoshenko, a former Prime Minister of Ukraine. Our methodology involved a comprehensive analysis of articles covering Tymoshenko from mainstream American media news sources, a review of academic papers focusing on her political career and public perception, and a comparative study between Tymoshenko and other female political leaders, such as Hilary Clinton and Margaret Thatcher. Tymoshenko, renowned as the Ukrainian "gas princess" in Western countries, rose to international prominence due to her critical role in the Orange Revolution, when her leadership was instrumental in overturning a fraudulent presidential election. Her charisma, amplified by a pro-Western populist narrative, was uniquely interwoven with her embrace of a traditional feminine role in the context of her political career, capturing significant attention from both domestic and international audiences. American media's representation of Tymoshenko was marked by a meticulous focus on her public image, including physical appearance, clothing choice, and adherence to notions of traditional femininity. The media's portrayal was predominantly positive, often downplaying the corruption scandals she was implicated in and framing her as a victim of circumstances. Notably, the American intrigue with Tymoshenko was not solely due to her fitting into the stereotypes of traditional femininity but also the unique juxtaposition of her strong political leadership and powerful rhetoric with traditional feminine aesthetics. Our study examines the complex interplay between politics, media, and gender, providing a deeper understanding of how they coalesce to form public perceptions of political figures. The American portrayal of Tymoshenko presents a compelling case study of how gender stereotypes affect the reception of political leaders and shape the narrative around their policies. These findings underscore the effect of gender norms on political discourse and public sentiment, suggesting a need for further dialogue and consideration in political reporting and analysis.

We thank the Carson Fund for financial support.

Poster 92

The Challenges of Restoring Caribbean *Acropora* Corals Amidst Ocean Warming Trends

A. Burton

Bay Islands Reef Restoration

Coral reefs are among the most valuable ecosystems on Earth, supporting one-quarter of all marine life, hundreds of millions of people through sustenance, shoreline protection, and income, and contributing \$375 billion to the global economy every year. The Caribbean has experienced an 80 % decline in the coverage of living coral over the last three decades due to human impacts and the emergence of new diseases affecting corals, notably White Band Disease (WBD). WBD has inflicted unprecedented harm upon two crucial reef-building corals, *Acropora palmata* and *Acropora cervicornis*. This presentation delves into a first-hand account of working with Bay Islands Reef Restoration, a non-profit organization in Roatán, Honduras, to restore Caribbean *Acropora* corals within the second largest barrier reef globally. Through scuba diving and qualitative observations, the relationship between ocean temperature and the transmission of WBD was studied. I focus on the experiences and lessons learned from the internship, particularly the intricate process of coral restoration amid the WBD epidemic. It was observed that the progression of WBD expedited during periods when relatively warm oceanic conditions were recorded, suggesting the latter's promotion of disease transmission. This could be due to the increased stress on coral's immune system in face of elevated temperatures. These observations highlight the broader context of coral reef conservation. While restoration efforts like those undertaken by Bay Islands Reef Restoration are crucial, their effectiveness is intrinsically linked to the larger issue of increasing ocean temperatures, which are thought to promote the transmission of incredibly harmful diseases such as WBD. Successful outplanting of coral fragments requires optimal health, which relies on a conducive reef environment. This demonstrates the need for a mutli-faceted approach that combines restoration with broader climate change mitigation strategies to ensure the sustained health of coral reef ecosystems.

I thank the Bushee Thorn Mountain Trust and Jackson Community Church for financial support.

Poster 93

Equitable Care and Equal Access: Are There Specific Factors Affecting Door to Balloon Time?

G. DiRaimo, J. Hernandez, S. Sokol, E. Gashi-Baraliu, and C. Marini

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The impact of insurance status (IS) on the timeliness to percutaneous coronary intervention (PCI) in patients with STEMI (ST segment elevation myocardial infarction) has been previously investigated. Medicaid and uninsured patients have a prolonged door-to-balloon-time (D2BT). This study was designed to assess the impact of demographics and IS on the time to coronary balloon inflation in patients with STEMI requiring PCI in a public hospital. The study includes 104 patients admitted to JMC from 6/8/2021 to 7/10/2023 for STEMI requiring PCI. Data, presented as mean \pm standard deviation (SD) and frequencies in %, including race, sex, age, BMI, IS, primary language (PL), hemodynamic status, D2BT, days of inflation, type of PCI, and outcome were analyzed with student t-test, chi-square, and logistic regression. Binary logistic regression was used to assess the association between demographics, IS, time to coronary balloon inflation ($t < 120$ minutes- ideal and ≥ 120 minutes- delayed), and factors predictive of 30-day mortality. Binary regression identified variables predictive of mortality at a $p < 0.05$. No difference in the distribution between groups stratified by time was found for any variables other than HR, PL, and mortality in the univariate analysis. When stratifying groups by outcome, there was a statistically significant difference between the distribution of ejection fraction (EjFr) and D2BT. However, HR, PL, and D2BT did not retain statistical significance in the logistical regression analysis. Our results do not corroborate previous reports that suggest that IS is a major predictor of delayed PCI in patients requiring hemodynamic support. An EjFr $< 30\%$ was associated with earlier coronary balloon inflation in our study. Mortality was affected by the presence of cardiac arrest before PCI and an EjFr $< 30\%$ with an OR 0.912 (95% CI 0.840 – 0.989). Race and IS do not affect the time to coronary balloon inflation in patients with STEMI requiring PCI in a city hospital. An EjFr $< 30\%$, but not D2BT, is predictive of mortality.

Poster 94

“Reimagining the Summer School Model”: The Goals of Summer Programming Post-COVID-19

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The COVID-19 pandemic negatively impacted the lives of numerous students nationally. With educational material building upon itself year after year, an event of this proportion significantly hinders the momentum of learning. Additionally, the pandemic led to a decline in mental and social health for students, due to feelings of isolation and loss. Given these unique challenges, school districts have been urgently searching for ways to remediate students' learning. Recent research has indicated that summer learning may be the key, with emphasis placed on both academic and social-emotional learning. With this in mind, this study sought to examine the nature of summer learning programs with the goal of answering the following question: What are the goals of summer school in Massachusetts post-pandemic? Utilizing a mixed-methods approach, we examined the middle school summer programs in 51 randomly selected public school districts across the state, with 17 unique artifacts from these districts (websites, applications, recruitment letters, etc.). We determined if districts had summer programming for middle school students, as well as what the program entailed (e.g. enrichment activities, math help, STEM, etc.). Utilizing the artifacts we collected, we determined common themes amongst the goals of programming. We found that, rather than a strictly academic focus, many programs have enrichment as a priority, characterized by themes of fun, creativity, and exploration. Furthermore, programs display a greater emphasis on social-emotional learning, encouraging the development of skills such as teamwork, identity development, and mindfulness. Based on what the districts are communicating, it appears that there is a departure from the emphasis on student deficits with regards to summer learning, moving instead towards a focus on what students can gain from their summer experiences.

We thank the Weiss Summer Research Program for their financial support.

Poster 95

Detecting Atmospheric Muons Using Muon Telescopes

M. Lawrence, L. Ivanoski, B. Alvarez, and T. Narita

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Muons are subatomic particles that commonly travel through the Earth's atmosphere. Categorized as a type of Lepton, and about 207 times heavier than electrons, muons are a fundamental building block described by the standard model, and often pass through solid objects. We took on the task of detecting the rate at which these muons reach the Earth by using muon telescopes on the roof of the science complex, while simultaneously working to automate updating the equipment. This required new telescopes to be placed on the roof, as well as the preexisting detectors from previous summers. This includes calibrating, maintaining, and repairing the active detectors, as they would occasionally experience difficulties. Particularly adjusting the High Voltage and Threshold Voltage settings, which respectively influence the sensitivity and noise minimization of each detector. In addition, we coded new ways to read and interpret the information that the telescopes were detecting. We used a system that would record the information received onto an SD card and then put it into a nice file to interpret in Excel. We used this interpreted data, as well as a temperature/pressure detector to track the state of our detectors and to note any potential effect that the pressure or temperature had on the data. The temperature/pressure detector would record fifteen-minute intervals so that we could compare our data with the exact atmospheric conditions at the time. Given that our detectors are all functioning properly, our hope is to use the detectors to eventually aid other experiments in becoming more precise. Oftentimes muons can be detected in other experiments involving measurements of radioactive decay, and will result in excess counts. With the aid of these updated telescopes, we hope to detect when exactly a muon hits a specific area so that these other experiments can discern that what is detected is really a false positive and not obstructing data.

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Poster 96

The Implementation of Muon Telescopes

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Cosmic ray muons are subatomic particles that travel throughout the universe. Muons specifically are a type of free particle meaning they are unaffected by the strong nuclear force. Unlike Protons, neutrons, and electrons, muons are an unstable particle, with a half life estimated of only $2.2\mu\text{s}$. Despite their short lifespan, muons that are emitted from sources such as the sun are able to reach the Earth's surface as they travel at relativistic speeds. We detect these with photomultiplier tubes (PMTs) on the roof of the science complex, our task was building and calibrating these telescopes. Many models show that the sun's electromagnetic field experiences an 11 year solar cycle, this cycle would influence an increased presence of muons. The standard expected rate of muons reaching our surface is 1 muon per cm^2 per minute. This conveniently indicates that, if properly calibrated, we should expect 277.12 muons/min (or 4.62 muons/s), as the-cross sectional area of our detectors is measured at 277.12cm^2 . Calibrating the detectors involves 2 different aspects. First is setting the High Voltage of an individual PMT, which adjusts the sensitivity to closer meet our expected rate of muon capture. The second is setting the Threshold Voltage, which serves as the primary method of noise minimization for a detector. In a completed telescope, one PMT is connected directly above another, so they run parallel to each other. The telescope is then wired so that a muon will only be counted if it passes through both detectors. This is done to better limit the range of direction that a muon will be detected, which is calculated using the solid angle of a rectangle, as a rectangle is roughly the shape of a PMT. In the future, we would like to compare the accumulated results of multiple years of muon data, and analyze the effects of the solar cycle on average count rate, noting periods of higher and lower detection yield.

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Poster 97

The Cyclic Nature of Atmospheric Muons

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Muons are free subatomic particles that commonly travel through space and enter the Earth's atmosphere at an expected rate of 1 muon per cm^2 . Categorized as a type of Lepton, and about 207 times heavier than electrons, muons are a fundamental building block described by the standard model, and are extremely unstable so they decay very quickly. We took on the task of detecting the rate at which these muons reach the Earth by using muon telescopes on the roof of the science complex, while simultaneously working to automate updating the equipment. This required new telescopes to be placed on the roof, as well as the preexisting detectors from previous summers. This includes calibrating, maintaining, and repairing the active detectors, as they would occasionally experience difficulties. In addition, we coded new ways to read and interpret the information that the telescopes were detecting. We used a system that would record the information received onto an SD card and then manually remove and insert the SD into a laptop where we would transfer the data into an Excel file where it could be interpreted. We used this interpreted data to see if there was any correlation between the time of day and amount of muons being detected. Using the Fast Fourier Transform we were able to check for cyclic patterns in the detection rate of the muons based on the time of day. The Fourier Transform is used to measure the frequency or how often an event occurs over time. The main use for finding the cyclic nature of muons in this context is to calibrate future muon detectors that are used in other experiments. This is because muons can interfere with other experiments involving radioactive decay so being able to identify when there is a muon detection is extremely important.

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Poster S 01

Working on the Publication of the Spanish Theater Journal:

Estreno: Cuadernos del teatro español contemporáneo

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Estreno: Cuadernos del teatro español contemporáneo was founded in 1975 and since then it has become the sole publisher in the U.S. of both scholarly articles and unedited plays exclusively on the theater of 20th and 21st century Spain. The purpose of this peer-reviewed bilingual journal has been to increase the visibility of Spanish theater from pre- and post-Francoist Spain. As a subscription-based journal, it is carried by approximately 200 university libraries worldwide, and the subscription revenue funds a conference that takes place every three years. Our work this summer has involved the editing, formatting, and publication of Volume 49 of *Estreno*, the first volume under the editorship of Prof. Papio. Documenting the journal's extensive 50-year history into a catalog, brainstorming new content ideas for *Estreno's* upcoming print volume, and proposing web design ideas for the brand-new website dedicated to preserving the journal's previously printed work digitally, have all been critical aspects of our work. By studying the best practices of other print and online Spanish and English theater journals, we can understand what sections should or should not be included in the new printed volume and on the website. For the website, our work has included the translation of content in Spanish and English (& vice versa) and finding links to showcase external media (playwright interviews, exciting images for web backgrounds, and writing blurbs for landing pages). The formal outcome will be the publication of the 49th volume this fall, alongside the new website with its catalogs, and bibliography. *Estreno* is a testament to the importance of preserving the historical memory of 20th and 21st-century Spain through its theater and sharing this knowledge with scholars around the world; it is also key to note that all *Estreno* editors ever have been women. With this profound legacy, the work that Professor Papio and I have produced this summer will help reinvigorate the life of this vital academic journal in a new and exciting way.

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Poster S 02

Cinegogía and Cineglos: Digital Humanities and Latin American Film

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In the world of contemporary Latin American cinema, the marginalization of Afro-descendant and indigenous communities persists. To bring increased visibility to these groups, we worked on expanding and updating [Cinegogía](#) and [Cineglos](#) with films that depict and, in many cases, were directed by Afro-descendant and indigenous peoples. Cinegogía is an open-access database focused on Latin American film studies, with resources in Spanish and English for researchers, students and instructors. Our work was multifaceted, focused on expanding the Film Guide collection, as well as on updating Cineglos - a Spanish-language audiovisual glossary of cinematographic terms accompanied by media clips from a wide range of Latin American and Spanish films. As part of our bilingual research, we created 16 Spanish and English language film guides, 59% of which were for full-length and short films that focus on Afro-descendant representation, and 41% on indigenous representation. Additionally, we screened 37 films, curating and cutting over 80 new examples which we edited and formatted to update Cineglos' embedded media clips. We also focused on diversifying representation from several countries in the region, specifically the Dominican Republic, Ecuador and Peru. By adding new film guides to Cinegogía and updating the decades-old media clips on Cineglos, we are providing scholars, educators, and students with access to more diverse resources within the field of Latin American Film Studies. Our research included, but was not limited to, cinematic media about and by Afro-Brazilians, Afro-Colombians and Afro-Venezuelans, as well as indigenous groups such as the Kaqchikel Maya (Guatemala), Mapuche (Chile) and Quechua (Peru). Through this multifaceted Digital Humanities project, we honed our bilingual skills, conducted scholarly research, learned new technical tasks such as screen grabbing and video editing, and participated in archival and curatorial film studies work.

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Poster S 03

Medieval Silks Across Cultures: Examining Iconographies in Textiles Related to Latin Translations Found in English Collections

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For thousands of years, silks bearing woven designs have been worn and used in many cultures. Our research witnesses the importation of silks from the Eastern Mediterranean, North Africa, and Asia as we examine further their presence on the social, political, and economic landscape in medieval England. Records written in medieval England, originally in Latin, describe silks with Islamic, Byzantine, and central Asian iconographies. These records have never been recognized before for their significance, yet they show the openness of English visual culture to influences of different groups of people throughout the 13th century. While they describe silks that have been lost, we spent our summer finding extant silks in both public and private collections that correspond to the Latin descriptions of imported silks. This enables us to see, for the first time, a representation of the impressive array of silks owned and used by medieval English individuals. Additionally, it allows us to track the probable original locations where these imported silks were made. We used a digital visual database to sort images of the silks and their identifying information. We can keep track of art objects relevant to the Latin translations that describe exactly what are visible on the silks. The trends we analyzed have been figural roundels that incorporate hunting scenes with humans and animals such as parrots, doves, lions, griffins, and other exotic mammals. The database captures similarities of art created by a variety of societies exhibiting their connectiveness to each other and nature. These images are reflected on textiles that were once used for robes, copes, buskins, and even in burial sites from England to Japan. Such figured silks were worn by travelers, and they were used in architectural settings such as cathedrals, monasteries, and caves. Their patterns also appear on other media such as metalworks, glass, or wood. This research shows how technology can enhance interaction with history and the visual arts.

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POSTER S04

Dispatches from the Future: Documenting New England Apples in a Wilding Climate

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Apples have a particular mnemonic resonance to most New Englanders, being a key component of the mythos of New England's foodways (Muckenhoupt, 2020). Most New Englanders from first grade on can proudly tell the story of Johnny Appleseed and show you on a map where his hometown of Leominster, MA, is located. The industrialization of our food system has dramatically reduced the variety of foodways, and perhaps nowhere else is this as apparent than with apples. A hundred years ago, there were thousands of varieties of apples, while today only a handful dominate the market in the US and elsewhere. Likewise, climate change has prompted concern regarding the diversity of apples. Most of the apples we have today have been selected for color (i.e., redness), durability rather than taste, and certainly not sustainability or resistance to climate change. In *Walden Warming*, Richard Primack (2014) notes that wild apples now flower two to four weeks earlier than they did when Henry David Thoreau wrote about them in the 1850s. Concerns about climate change and apple diversity have prompted two burgeoning movements. The first takes place in the lab where scientists are engineering climate resistant apples. The second takes place in fields and farms, especially where development has occurred and trees have been "lost" or with "wild" apples (apples that are "uncultivated" (Brennan, 2020) i.e., from "found" trees, pippings/seedlings) where foragers, especially cider makers, are looking for apples that have successfully grown for years without human intervention. This documentary is focused on the latter, in particular on how cider makers and orchardists in New England are preparing for climate change.

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POSTER S05

Hyperbolic Voronoi Diagrams of Horocycles

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The geometry we learn in our high school math class is founded on a set of five ancient rules (postulates) written down by the Greek mathematician Euclid. Unlike the rest, however, the fifth postulate could never be derived from the others; rather, it had to be independently assumed true. Hundreds of years later, mathematicians (including Lobachevsky and Bolyai) succeeded in developing versions of geometry that actually assumed Euclid's fifth rule was false yet were still internally consistent. Many ideas translate from Euclidean to non-Euclidean geometry but require rethinking intuitive concepts. In hyperbolic space (using the upper half plane as a model), length is measured such that the closer to the x-axis, the longer the distance between two points. What we call 'lines' and 'line segments'—the shortest path between two points—are actually either semicircles centered on the x-axis or straight vertical lines. On a separate note, imagine a plane with multiple objects, such as a set of points. The Voronoi diagram of that plane is the creation of sections such that everything in a particular section is closer to the point in that section than any other point. Otherwise said, the section boundaries are lines that are exactly the same distance from two neighboring points. What if the objects are circles instead of points? If they're the same size, the section border is just a straight line. If they're not, it curves a bit towards the smaller circle. What if we are in a non-Euclidean space? What do the section boundaries of the Voronoi diagram look like then?

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POSTER S06

On Your Own:

Maintaining Creative Motivation Post Graduation

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Very few artists continue to make art once they graduate and leave studio art courses behind. This sudden lack of structure and an artistic support system leaves new graduates with uncertainty on where to begin their artistic journey on their own. Many of these graduates fall prey to the inability to find motivation, art block, or self-doubt. Considering the psychological aspect of what goes into the creation of art, there are also other factors that make continuing to create art even more difficult such as ADHD. My own ADHD has come to heavily influence, and eventually, direct how I conducted my research and think about my findings. In order to address the dilemma of how to keep making art after losing the structure of art-making in an academic setting, I collected information from reading literature by practicing artists and conducting interviews with curators and other positions within museums and galleries on the topic of self-motivation within the process of creating art. I also interviewed several curators and two art therapists as I explored other aspects of art-making and the role of psychology in motivation. Using this information, I tested various tips, tricks, and prompts in my own daily art-making while documenting my experiences with each, along with how my ADHD affects the effectiveness of them, on the social media platform, Instagram. Alongside my daily posts, I wrote reviews of the books I read in order to make the search for reading material on the subject easier for those looking for it. Through the course of this project, the process of documenting my experiences, and further research, I found that the most helpful advice promoted self-enforced structure and deadlines, encouraged artists to put less stock in the opinions of others, recommended allowing the work of others to inspire your own, and reminded individuals that quitting their passion altogether is the worst thing they could do.

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