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**24TH ANNUAL
CELEBRATION OF
STUDENT RESEARCH,
SCHOLARSHIP,
& CREATIVE WORK**

JANUARY 26, 2024 | WABASH COLLEGE

Congratulations!

The Celebration Event Planning Committee is excited to announce the winners of two prestigious awards associated with today's event.

Celebration Research, Scholarship, and Creativity Awards

These \$150 prizes are awarded to the students who most effectively articulated gains in professional development and personal growth as a result of their research, scholarship, or creative work. This year's winners are listed below, in alphabetical order.

Andrew Sinkovics & Phenix Carney: *Léanme: Spanish Children's Literature*

Jackson Hoover: *Food for Thought: Finding New Solutions for Food Insecurity and Promoting Impactful Internship Experiences*

Nhan Huynh: *Drug-Resistant Melanoma is Mediated by DNA Damage*

Robert Wedgeworth '59 Library Research, Scholarship, and Creativity Awards

These \$750 prizes are awarded to recognize effective use of library resources in the preparation of Celebration work. This year's winners are listed below, in alphabetical order.

Carson Wirtz: *Ghostbusters: The Strange Thing in Your Neighborhood is Political*

Christan Zimmerman & Luke Davis: *Photoredox Catalysis with Organic Photocatalysts*

Christan Zimmerman, Zephaniah Johnson, & Jackson Bohrer: *Impact of Awe Induction on Creativity*

Welcome and Introduction

Welcome to the 24th Annual Celebration of Student Research, Scholarship, and Creative Work at Wabash College. For the past 23 years, the College has recognized in a proud and public way the creative accomplishments of Wabash students. We celebrate not only the particular achievements of individual students, but also a deeply embedded ethos of the College. The impressive breadth and quality of student creative work is evidence of the challenge and change that marks the Wabash experience.

This program is dedicated to the memory of Paul Caylor McKinney '52, who passed away in 2003 after a courageous battle with cancer. Dr. McKinney proudly served the College for more than half a century as chemistry teacher, department chair, division chair, and Dean of the College. He was an exemplar of the liberally educated person whose interests ranged from quantum mechanics to Plato, from playing the piano to pondering Nietzsche. He acted in Wabash College Theater productions and was often found backstage working on difficult equations in his notebook. He was a master teacher who helped countless Wabash students develop their creativity and love of the liberal arts. Likewise, he encouraged new faculty to embrace the culture of the College. I fondly remember the encouragement he gave me to teach in the Wabash first-year program and his mentorship on a teaching and learning project on which we collaborated. Among Wabash men, he would well understand and appreciate everything presented today; he would be the first to celebrate the successes of Wabash students and faculty members.

Close collaboration between Wabash students and faculty across the College is a hallmark of our culture, a labor of pedagogy and love that makes a difference for our students. It is a special pleasure to introduce some of the results of that collaboration in these presentations. Our thanks go to the students who are prepared to teach the Wabash community about their good work and to the faculty and staff members who have devoted considerable time helping students in their research and creative productions.

A conference of this size and scope would not be possible without the dedicated work of many people. I want personally to express my thanks to the planning committee: Chair Lon Porter, Jeff Gower, Michelle Janssen, Evan Miller, Joe Scanlon, Nicholas Snow, and Sarin Williams. Andrew Taylor and ETS students contributed to the poster production, as have other ETS and IT Services staff; Mark Siegel authored the online event presentation application system; Becky Wendt provided the program book template; Brandon Rash and his team recorded presentations, Julia Phipps created the campus event poster, Linda Weaver supplied presenter nametags, Campus Services prepared the event space, and Mary Jo Johnston and her Bon Appetit staff make the logistical support appear effortless. Finally, we are grateful to all of you whose attendance supports this community Celebration.

—Todd McDorman, Dean of the College

Schedule for Oral Presentations & Performances

Oral presentations and performances will begin at 1:15 p.m. and continue every 25 minutes. The last session begins at 3:20 p.m. In general, students will present information or perform for 15 minutes with a 10-minute pause between presentations for questions, technology reset, and passing time. Please see the following pages for a list of oral presentations and performances by room location and time slot. Names of the presenters, as well as their sponsors and abstracts, are listed in alphabetical order beginning on page 11.

Schedule for Poster Presentations & Exhibitions

Students will present and discuss their posters and exhibits in 60-minute increments beginning at 1:15 p.m. and 2:30 p.m. in Detchon International Hall. You will find a list of presenters and their time slot beginning on page 7. Names of the presenters, as well as their sponsors and abstracts, are listed alphabetically beginning on page 21.

Enjoy Delicious Treats on the Detchon Balcony

A wonderful selection treats will be available on the second-floor balcony, overlooking the poster sessions.

Oral Presentation & Performances Schedule

Detchon 109

1:15	Caleb Peare	The Timeless Echo of Guernica V. Daniel Rogers & Matthew Greenhalgh (Spanish)
1:40	Owen Bennett	Reconstructing Henry S. Lane: Redefining Political Legacy Amidst Reconstruction Ambiguity Noe Pliego Campos (History)
2:05	Gavinn Alstott	The Rise of Fundamentalists in Politics Robert Royalty (History)
2:30	Chase Breaux	The Impact of Partisan Cues on Black Voter Support of Racial Equity Policy Shamira Gelbman (Political Science)
2:55	Gavin Hill & Christopher Runyo	Dividing the Lobbyists: Subgroups within the Administration of the 1946 Lobbying Act Shamira Gelbman (Political Science)

Detchon 111

1:15	Thomas Oppman	Small Ultra Red Fluorescent Protein as a Potential pH Biosensor in Human Cancer Cells Walter Novak (Chemistry)
1:40	Cole Shifferly & Nhan Huynh	Hot in Herre: The Effect of Temperature on Proteasome Activity Erika Sorensen-Kamakian (Biology) & Walter Novak (Chemistry)
2:05	Augustin Sanchez & Evan Baldwin	Untangling Entanglement: Investigating the Creation and Destruction of One of Nature's Most Confusing Phenomena Dennis Krause (Physics)
2:30	James Szalkie	Imaging Sound Waves in Translucent Materials James Brown (Physics)
2:55	Evan Baldwin	Entangling Ourselves with Entanglement: A Closer Look at the Meaning of Entanglement and Quantum Correlations Dennis Krause (Physics)

Oral Presentation & Performances Schedule

Detchon 112

1:15	Jackson Grabill	Institutional Design Matters: Issues with the Constitutional Framework of the Supreme Court Nicholas Snow (Philosophy, Politics, & Economics)
1:40	Joseph Barnett	In Defense of Dollar Stores: A Closer Look into the Relationship between Dollar Stores and Consumers Nicholas Snow (Philosophy, Politics, & Economics)
2:05	Jackson Leeper	Water Borne Disease Dynamics on a Random Network with a River Chad Westphal (Mathematics & Computer Science)
2:30	Derek Miller	Decolonial Thought of Critical Race Theory Jorge Montiel (Philosophy)
2:55	Matthew Jessup	Trading on AI Insights: Evaluating Forex Predictions from Central Bank Statements Eric Dunaway (Economics)

Detchon 209

1:15	Cody Bevelhimer	Beyond Sound: The Immersive Impact of Video Game Music Mollie Ables (Music) & Michael Abbott (Theater)
1:40	Io Maeda	Paul Hindemith: A Suppressed German Composer by the Nazi Regime Mollie Ables & Diane Norton (Music)
2:05	Evan Bone	Aimé Césaire's Influence on Modern Hip-Hop Agata Szczeszak-Brewer (English)
2:30	Jacob Weber & Noah Kent	How Jason Aldean uses Race as a Rhetorical Function: An Analysis of <i>Try That in a Small Town</i> Jennifer Abbott (Rhetoric)
2:55	Carson Wirtz	<i>Ghostbusters</i> : The Strange Thing in Your Neighborhood is Political James Cherry (Theater)
3:20	Jacob Weber, Cole Bergman, Christan Zimmerman, & Benjamin Mijangos Sampsell	From Theoretical to Tangible: The Political Turn in Environmental Policy Deliberation Chris Anderson (Democracy & Public Discourse)

Oral Presentation & Performances Schedule

Detchon 211		
1:15	Zachary Geleott & John Mills	Wabash Always Fights: The Unintended Side Effects of our Mantra Michele Pittard (Education Studies)
1:40	Zev Wolverton	Rediscovering Chapel Sing Michele Pittard (Education Studies)
2:05	Preston Reynolds & Logan Weilbaker	A More Perfect Writing Center Zachery Koppelman (Writing Center)
2:30	Matthew Lepper	Effects of Rhizobial Diversity on Soybean Health Bradley Carlson (Biology)
2:55	Jackson Hoover	Food for Thought: Finding New Solutions for Food Insecurity and Promoting Impactful Internship Experiences Eric Wetzel & Jill Rogers (Global Health Initiative)

Korb Classroom		
1:15	Jacob Riddle	The World through My Lens Matt Weedman (Art)

Poster Presentations & Exhibitions Session #1 Schedule

Detchon International Hall		
1:15–2:15	Matthew Jessup	Evaluating Racial Bias in AI Language Models Joyce Burnette (Economics)
	Reece Bauer	Wage Discrepancies: Examining the Wage Gap Between United States Born Citizens and Immigrants Joyce Burnette (Economics)
	Connor Craig	Mitigating Black Maternal Mortality Health Disparities Elan Pavlinich (English)
	Seth Acero	Layers of Desire: Exploring Aggression, Objectification, and Male Receptiveness in Pornography Elan Pavlinich (English)
	Augusto Kern Ghidini	The Love for Notre Dame: From Hugo's Famous Novel to Dr. Pardoen's Efforts Renee Altergott (French)
	Benjamin Casica-Patton	Underwater Soundscapes: Exploring Debussy's <i>La Cathédrale Engloutie</i> Renee Altergott (French)
	Alexander Worley, Yuma Ozaki, & Reese May	Senior Capstone Game Demo Colin McKinney & Qixin Deng (Mathematics & Computer Science)
	Artie Rogers, Cole Borden, & Evan Kanetkar	ACE NBA MVP Prediction Rating Application Colin McKinney & Qixin Deng (Mathematics & Computer Science)
	Drake Hayes, Owen Runge, & Kazi Fardinul Hoque	Machine Learning-Based Vacation Recommender Colin McKinney & Qixin Deng (Mathematics & Computer Science)
	Arman Luthra	Exploring the Dynamics of Transnational Financial flows through Computational Linguistics: Forecasting Remittance Patterns among the Indian Diaspora in Canada Nicholas Snow (Philosophy, Politics, and Economics)
	Gavin Hill	Food Deserts and Political Participation Huei-Jyun Ye (Political Science)
Posters and exhibitions presented in this session continue onto the following page.		

Poster Presentations & Exhibitions Session #1 Schedule

Detchon International Hall		
1:15–2:15	Christan Zimmerman, Zephaniah Johnson, & Jackson Bohrer	Impact of Awe Induction on Creativity Neil Schmitzer-Torbert (Psychology)
	Joshua Manfred & Corbin Strimel	Kandinsky was Right: Few do “Express Bright Yellow in the Bass Notes, or Dark Lake in the Treble” Karen Gunther (Psychology)
	Luis Rivera	Political Affiliation Affects Spoken Language Processing Karen Gunther (Psychology)
	Andrew Sinkovics & Phenix Carney	Léanme: Spanish Children's Literature Matthew Greenhalgh (Spanish)
2:15	Break	

Poster Presentations & Exhibitions Session #2 Schedule

Detchon International Hall

2:30–3:30	Dalton Kuhn & Eero Gross	Quantifying Intracellular Calcium to Better Understand Endoplasmic Reticulum Stress and Lipotoxicity Heidi Walsh (Biology)
	Jacob Lawson	Investigating the Role of Inositol Trisphosphate Receptors in Endoplasmic Reticulum Stress Responses Heidi Walsh (Biology)
	John Schnerre	Proper Blastema Formation Requires Innervation in Aeolosoma (Annelida) Patrick Burton (Biology)
	Justin Lewis	Testing for Top-Down Ecological Effects of Eastern Box Turtles Bradley Carlson (Biology)
	Taylor Lorsung	Lonafarnib and Dizocilpine Inhibits Annelid Aeolosoma Regeneration Patrick Burton (Biology)
	Troy Brown & Samer Halabi	Broad Spectrum Antimicrobial Properties of a Wabash Field Isolate Anne Bost (Biology)
	William Keeling & Mason Naaman	Appetite for Destruction: Purification of the 26S Proteasome in <i>C. elegans</i> Erika Sorensen-Kamakian (Biology) & Walter Novak (Chemistry)
	Alex Amore & Eric Green	Molecular Rotors Encapsulated in a Palladium Chloride Coordinated Hexagonal Macrocyclic Framework Joe Scanlon (Chemistry)
	Ayden Lutes, Alex Amore, Patrick Countryman, & Eric Green	Potential Energy Surfaces of Hexagonal Macrocycles Joe Scanlon (Chemistry)
	Christan Zimmerman & Luke Davis	Photoredox Catalysis with Organic Photocatalysts Annah Kalb (Chemistry)
	Henry Giesel	The Effects of Notch Signaling on Fusion Erika Sorensen-Kamakian (Biology) & Walter Novak (Chemistry)

Posters and exhibitions presented in this session continue onto the following page.

Poster Presentations & Exhibitions Session #2 Schedule

Detchon International Hall

2:30–3:30	Augustus Isaac	Prokaryotic Puppetry: Mastering the Art of Bacterial Degradation with LOCKR Walter Novak (Chemistry) & Erika Sorensen-Kamakian (Biology)
	Jerry Little, William Boswell, & Jordan Carter	Taking Out the Trash: Developing a Protein Degradation Assay for LOCKR Walter Novak (Chemistry) & Erika Sorensen-Kamakian (Biology)
	Nhan Huynh	Drug-Resistant Melanoma is Mediated by DNA Damage Walter Novak (Chemistry) & Erika Sorensen-Kamakian (Biology)
	Thomas Oppman, Precious Ainabor, Nathanael Mertz, Cole Shifferly, & Andrew Sinkovics	De'feeting' Barriers to Binding: An Analysis of Toeholds in LOCKR Walter Novak (Chemistry) & Erika Sorensen-Kamakian (Biology)
	Bernardo Morales	Rocketry: Designing and Testing a Rocket Nathan Tompkins (Physics)
	Bryan Cherry & Aiden Orcutt	Analyzing Precipitate Membrane Growth with Varying Current Utilizing Microfluidics Nathan Tompkins (Physics)

Oral Presentations & Performances (Alphabetical by Presenter)

Presenter: Augustin Sanchez & Evan Baldwin
Sponsor: Dennis Krause (Physics)
Title: Untangling Entanglement: Investigating the Creation and Destruction of One of Nature's Most Confusing Phenomena

Of all the strange phenomena in quantum physics, none can quite compare to the imagination and ire that entanglement causes. A quantum phenomenon with no robust classical counterpart, entanglement is fundamental to our understanding of the quantum world but is at the same time poorly understood by undergraduates because it is mostly neglected in textbooks. Some of the biggest and most fundamental questions that are often ignored are why do we not see entanglement in our classical world, and how do we create and destroy entanglement? This project sought to answer these questions by using simple models rooted in an undergraduate's intuition of other physical concepts in an attempt to demystify the idea of entanglement, and in so doing created simple yet novel solutions that are readily accessible even to those without a significant knowledge of quantum physics.

Presenter: Caleb Peare
Sponsor: V. Daniel Rogers & Matthew Greenhalgh (Spanish)
Title: The Timeless Echo of *Guernica*

Throughout this past semester, in my Spanish 401 Senior Seminar Class, I researched for and wrote a paper investigating the ways that *Guernica* (1937), a painting by Pablo Picasso, has remained relevant throughout history. In the oral presentation, I will give a brief history of the event that led to the creation of the artwork, state a thesis, and relate key historical moments in the life of *Guernica* to the present day. Specifically, I will tell how its first appearance at the World Fair in Paris in 1937 resulted in *Guernica* being seen as ugly and as a weapon against those it exposed. I will explain to the audience how its ugliness is key in our contemporary society and how the painting continues to be a weapon in the 21st century. In the next part of the presentation, I will state what appropriation art is, how it was impactful in the 1960s for *Guernica*, and how it has been relevant in our modern times.

Presenter: Carson Wirtz
Sponsor: James Cherry (Theater)
Title: *Ghostbusters*: The Strange Thing in Your Neighborhood is Political

Ghostbusters and *Ghostbusters 2* are two of the most memorable and notable films of the 1980s. These two quintessential paranormal comedies, both directed by Ivan Reitman, and written by Dan Aykroyd and Harold Ramis, were massive successes at the box office that brought on cartoon shows, multiple re-boots, comic books, and more. Beneath the surface of the success, humor, and the catchy theme song of these films though, is a river of politics many audience members will completely miss or ignore. In *Ghostbusters*, the political messages and policy of President Ronald Reagan are reflected through the antagonizing of the Environmental Protection Agency, the depictions of masculinity and gender roles, the promotion of private business, and depictions of New York City. In *Ghostbusters 2*, these politics are repeated through criticism of government control, a push against negativity, a further message of masculinity and fatherhood, and a critique of immigration or being non-American. Furthermore, these political messages created a legacy in these films that are linked to the failure of the *Ghostbusters* 2016 re-boot and the political messages during the 2016 presidential election.

Oral Presentations & Performances

Presenter: Chase Breaux
Sponsor: Shamira Gelbman (Political Science)
Title: The Impact of Partisan Cues on Black Voter Support of Racial Equity Policy

Black Americans face racial inequities in nearly every aspect of American life – from how safe childbirth is to the amount of wealth they have and the neighborhoods they live in. Racial equity policies are policies intended to alleviate these racial inequities. To further these efforts, it's essential that the people the racial equity policies are intended to benefit are in support of them. In this experiment, I examine how partisan cues from the political elite affect Black voter support of racial equity policy – specifically reparations for descendants of people enslaved in the U.S. and shifting funds from the police force to social services. Through this, I aim to explore whether political elite messaging is an effective method to build support amongst voters for racial equity policies. The findings show that political cues may have a negligible impact on Black voters' policy attitudes toward racial equity policies. However, relatively high rates of neutrality and unsureness around the policies indicate that there may be a benefit in exploring voters' knowledge of racial policies to see if this is due to not being knowledgeable of them.

Presenter: Cody Bevelhimer
Sponsor: Mollie Ables (Music) & Michael Abbott (Theater)
Title: Beyond Sound: The Immersive Impact of Video Game Music

In modern media, whether it be movies, games, videos, television, or any other form, music plays a critical role in one's experience. Music does much more than just fill the silence. Composers create music with intention to portray certain emotions or feelings to their audience. My research focuses on the field of "ludomusicology," also known as the study of video game music, where I specifically researched "leitmotif" and its functions. Popularized by Richard Wagner, a leitmotif is a short reoccurring musical phrase that is associated with specific characters, locations, emotions, or themes. Some of the most well-known examples of this are the "Imperial March" from "Star Wars," associated with Darth Vader, or the iconic four note whistle from "The Hunger Games" that sparked a rebellion. Similarly, many video game series like "The Legend of Zelda" and "Final Fantasy" utilize leitmotif in their musical scores too. Through an analysis of unique instances of leitmotif in the video game "Undertale," I'll discuss the importance of music in video games. Showing how music can remove the player from the physical world and place them inside the video game world instead.

Presenter: Cole Shifferly & Nhan Huynh
Sponsor: Erika Sorensen-Kamakian (Biology) & Walter Novak (Chemistry)
Title: Hot in Herre: The Effect of Temperature on Proteasome Activity

Maintaining a balance between functional and damaged proteins (proteostasis) is crucial for healthy cells. When cells accumulate unnecessary and dysfunctional proteins, it can lead to onset of neurodegenerative disease like Alzheimer's. To avoid this, cells use a molecular machine called the proteasome to break down excess proteins. Previous research in animals suggests that proteasome activity decreases with high temperatures. However, the impact of long-term temperature exposure on proteostasis at an organismal level is not well-described. We investigated the long-term effects of temperature on proteasome activity in *C. elegans* (worms) and hypothesized that growing worms at low temperature (15°C) would show differences in proteostasis than those grown at high temperature (25°C). Surprisingly, we found that two types of proteasomal activities were higher at low temperature, whereas another type was more active at higher temperature. We also observed protease activity (non-proteasome protein degradation) was enhanced in worms grown at low temperatures. Understanding the impact of temperature on protein activity levels highlights the importance of considering temperature when studying proteostasis in whole animals.

Oral Presentations & Performances

Title: Derek Miller
Sponsor: Jorge Montiel (Philosophy)
Title: Decolonial Thought of Critical Race Theory

This paper aims to understand the goal of decolonial philosophy as a way of understanding the full truth behind history, while also looking at a more specific example of what I would consider self-colonization (maybe). A major issue in contemporary America is the intellectual movement and framework of legal analysis, critical race theory. These are two completely different scopes, but this paper aims to understand real history, which will in turn help future philosophers and everyday citizens in America understand how the denial of critical race theory in our country is a form of self-colonization. My paper will take a look at multiple sources surrounding the ideas of Eurocentrism, race, socio-genesis, capitalism, critical race theory, and why people may not support critical race theory. Through these ideas, I look to form an argument of how our world history is flawed since it is written by the victors. It is on us, at any scale of society, to make the necessary changes and understand what our ancestors went through. This is a difficult task to complete for most because so much history was erased through colonization and the rationale that was used has distorted the image of real history in each of us. The work of decolonial philosophers is to critically examine and understand the dominant ideas of the world by rewriting what we originally were told. We are at a moment in time where we have the ability to research and learn from our world history on how we should act and how we must break this cycle of colonization, modernity, and violence through different institutional practices.

Presenter: Evan Baldwin
Sponsor: Dennis Krause (Physics)
Title: Entangling Ourselves with Entanglement: A Closer Look at the Meaning of Entanglement and Quantum Correlations

Entangled particles are a significant part of quantum mechanics, yet very little is known about its inner workings. We know that it exists and how they could be made, but what is entanglement? Or, more specifically, what sets it apart from non-quantum relations? In this presentation, I will be using information theory to discover a difference between entangled and classically correlated particle systems and show that describing quantum correlations is not as difficult as it seems. I'll also introduce a new categorization for these entanglements based on real-world situations, and the interesting results that these scenarios can bring. We might be able to start toward a fundamental question of the universe while we are at it. Don't worry; for all of this talk of "quantum" and "information theory", no background in science is needed to be able to understand this amazing phenomenon. All you need is 15 minutes and the want to learn some of the fundamental mechanics of how our universe functions.

Presenter: Evan Bone
Sponsor: Agata Szczeszak-Brewer (English)
Title: Aimé Césaire's Influence on Modern Hip-Hop

This presentation will examine Aimé Césaire's *Notebook of a Return to My Native Land* and the discography of Thebe Kgositsile; specifically, I will look at the motifs of home and exile in *Notebook* and trace their influence to the work of Kgositsile. *Notebook* explores the effects of colonialism on the identity of Martinicans and how the history of colonialism has created an inferiority complex in the consciousness of the colonized. Césaire's language breaks the mold of any previous poet as he navigates countless perspectives on his own heritage identity. *Notebook* is an attempt to reshape one's identity on your own terms and in your own words. Césaire's approach to self-expression, defined by his groundbreaking language and his critical analysis of his heritage, is echoed by the works of some hip-hop artists today. Thebe Kgositsile's unique lyricism and experimental sound are tools of expression used to convey his struggle to create his own sense of self. Kgositsile inherits this tradition of black artists who explore the affects of colonialism on identity but Kgositsile's struggle is rooted in the present; Kgositsile analyzes his heritage of colonial resistance that came out of the Negritude movement. By comparing Césaire's writing to the music of Kgositsile's music, we can see an evolution in how postcolonial artists identify themselves in relation to the colonial struggle. Kgositsile's sense of pride for the colonial struggle is contrasted by his feelings of unbelonging caused by his father's participation in the colonial struggle. Putting these two artists in conversation with each other allows us to see how the narrative of colonial resistance has evolved following the fall of colonialism.

Oral Presentations & Performances

Presenters: Gavinn Alstott
Sponsors: Robert Royalty (History)
Title: The Rise of Fundamentalists in Politics

American Fundamentalism is best understood as the right-wing religious doctrine of evangelicals. Moreover, their eschatology or view of the end times, dispensational premillennialism, has been influential in America since 1980. Dispensational premillennialists believe that Christ will return to inaugurate a literal 1,000-year reign on Earth, which they connect to biblical prophecies. Fundamentalist political involvement raises a paradox: many Fundamentalists who expected the world's imminent end also worked tirelessly to influence government and society. Through historical analysis of important fundamentalists who influenced conservative politics such as Jerry Falwell, Pat Robertson, and Ralph Reed since the 1980s, I will attempt to unpack this paradox. I will explain how these figures have impacted presidential elections such as Ronald Reagan, George H.W. Bush, George W. Bush, and Donald Trump. More recently, the rise of Christian nationalism has become even more mainstream. Still, it has left many Christians questioning whether they have succumbed to worldly political power in an attempt to hasten a realized eschaton. This raises many questions: Why did Christian Fundamentalists rise in their political influence? And, how? To what extent does their view of eschatology influence their political actions? And where do evangelicals go from here?

Presenters: Gavin Hill & Christopher Runyon
Sponsors: Shamira Gelbman (Political Science)
Title: Dividing the Lobbyists: Subgroups within the Administration of the 1946 Lobbying Act

The 1946 Lobbying Act was a crucial moment for lobbying rules in the US. This law made it mandatory for lobbyists working at the federal level to register and submit reports about their spending every three months. This requirement aimed to bring more openness and responsibility to how people influenced politics.

Our research focuses on this act's early days. We collected and studied a lot of information – about 700 registrations and 850 reports from the first year it was enforced. We wanted to know: "How did lobbyists deal with the new 1946 Lobbying Act?"

To answer this question, we organized the data and discovered five different groups among the first lobbyists. We used both numbers and detailed information from the reports to understand what these groups were about. We also highlighted specific people who were great examples of each group. Additionally, we looked at how the actions of these early lobbyists affected the way lobbying happened later on.

Our goal is to dig into the history and patterns of lobbying in the federal government. By doing this, we hope to give more insight into how lobbyists worked during the early times of lobbying rules. This can help us understand the strategies used by lobbyists when these rules were just starting to be put in place.

Oral Presentations & Performances

Presenters: Io Maeda
Sponsors: Mollie Ables & Diane Norton (Music)
Title: Paul Hindemith: A Suppressed German Composer by the Nazi Regime

This paper examines German composer Paul Hindemith's career in the Third Reich from 1933 to 1938, when he emigrated to Switzerland. This paper analyzes Hindemith's career life and works thoughts year by year, and at the same time analyses three of his pieces for orchestra which he composed during this period he stayed in the Third Reich: symphony and the opera *Mathis Der Maler*, a viola concerto *Der Schwanendreher*, and a suite for viola and string orchestra *Trauermusik*. Despite critical success abroad, Hindemith music was suppressed by Hitler's regime.

Hindemith's career reflects the conditions for many non-Jewish composers working in Nazi Germany. During this period, government organizations like Alfred Rosenberg's *Kampfbund für deutsche Kultur* and Joseph Goebbels' *Reichskulturkammer* attempted to set standards for German music. These standards, however, were vague and inconsistent.

It can be concluded that Hindemith emigrated from Nazi Germany with his wife due to financial necessity rather than political suppression so that he could make a living and he could continue to be active as a musician/composer. No musician/composer's career and life were guaranteed in the Nazi Germany. Only the dead German musicians/composers were safe because they died before the Third Reich was born.

Presenters: Jackson Grabill
Sponsors: Nicholas Snow (Philosophy, Politics, & Economics)
Title: Institutional Design Matters: Issues with the Constitutional Framework of the Supreme Court

The recent increase in public criticism and decrease in public trust in the Supreme Court suggest issues with the Court. The common law tradition requires judges to consider their biases in judicial decision making. The American judiciary should fulfill three goals: protect individual liberties, restrict coercive actions by the government, and preserve the balance of powers in our federal system. Judicial independence is crucial to achieving these three normative goals. Additionally, the Framers designed our federal judiciary to preserve individual liberties and regulate our federal balance of powers. However, the Court has become too powerful, practically acting as a policymaker, because our constitutional structure does not place strong checks on judicial power. I argue that the Supreme Court is fulfilling the major duties of the judiciary and operating in the way in which the Framers designed the Court to act. Thus, the issue with the Supreme Court is not any individual actors or influences, but with faulty institutional design in the first place. We need more institutional checks on the Court's power.

Presenters: Jackson Hoover
Sponsors: Eric Wetzel & Jill Rogers (Global Health Initiative)
Title: Food for Thought: Finding new Solutions for Food Insecurity and Promoting Impactful Internship Experiences

The social determinants of health (SDOH) and specifically food insecurity are prominent factors that contribute to chronic illnesses, decreased life expectancy, and decreased quality of life. Food insecurity impacts 1 in 6 Indiana residents, so understanding the factors that influence food insecurity is paramount to improving the health and wellbeing of people in our communities. This presentation will delve into the effects of food insecurity on health outcomes, differentiate the roles of food banks, food pantries, and government sponsored programs, and call for the implementation of proactive methodologies. While some programs currently exist to help people afford nutritious foods (SNAP, WIC, TEFAP, etc.) there are still many barriers to entering these programs. Finally, I will draw upon my internship experiences working with Gleaners Food Bank and the Crooked Creek Food Pantry (CCFP) to demonstrate what I have learned about the relationship between food insecurity and health outcomes, what measures have been taken in the past to expand access to nutritious foods, and what still needs to be done to close the meal gap.

Oral Presentations & Performances

Presenters: Jackson Leeper
Sponsors: Chad Westphal (Mathematics & Computer Science)
Title: Water Borne Disease Dynamics on a Random Network with a River

A wide range of waterborne diseases spread through a population through both human-to-human interaction and water-to-human interaction. In this presentation, we propose a compartment model to simulate the transmission of a waterborne pathogen through a river with two water sources. We create different systems like an ODE simulation and a Markov Chain Monte-Carlo simulation to see how the disease spreads through a population differently based on the characteristics of the simulation. We also implement a randomly generated graph with limited connections to the Markov Chain Monte Carlo model to account for each person and simulate real-world scenarios. This river has an upstream and downstream compartment with a flow parameter in between them. We also create a range of interventions to eradicate this disease. We also describe how to solve for the basic reproduction number, also called R_0 , as well as the fraction of the population when the disease becomes endemic, also called i -infinity, as well as equilibrium solutions. We describe how to solve for these metrics as well as solving for equilibrium solutions using matrix-based analytical techniques. Then, we try to decrease R_0 and i -infinity using interventions while using local change and global change using LHS/PRCC to see which interventions are most effective in decreasing R_0 and i -infinity.

Presenters: Jacob Riddle
Sponsors: Matt Weedman (Art)
Title: *The World through My Lens*

Jump into Jacob Riddle's cinematic world as he showcases the imagery from his films throughout his time at Wabash College. In a five-minute reel, he shows you the power and prestige of moving pictures. His cinematography and visual storytelling have grown throughout his four years. Experience the journey he has taken to get where he is today.

Presenters: Jacob Weber, Cole Bergman, Christan Zimmerman, & Benjamin Mijangos Sampsell
Sponsors: Chris Anderson (Democracy & Public Discourse)
Title: Impacts on Income Inequality from the Aftereffects of Financial Crisis with Market Expectations and Macroeconomic Factors

Deliberation has been an increasingly popular tool to address complex and ever-changing problems facing diverse stakeholder groups at all levels of government. One goal of deliberation is to engage stakeholders in understanding the underlying values of a problem through interaction with content experts and allowing those stakeholders to identify preferred action steps. Environmental clean-up efforts are popular deliberation topics because of the widespread impact as well as the need for community trust in executing a successful solution. Using model deliberations across two different college campuses we identify a shift in deliberative conversation as participants moved from idealistic abstract problem solving to constrained local solution seeking on the issue of water contamination. As the deliberation moved from examining popular national cases like Flint, MI to more contextual and localized issues participants invoked political structures and the role of government. In the former half of the deliberation participants seemed to be idealistic but in moving to the latter half of the deliberation discussion was stalled by a political turn among the participants. Identifying this shift within the deliberation helps deliberative practitioners and government officials develop better tools for addressing environmental issues with community engagement.

Oral Presentations & Performances

Presenters: Jacob Weber & Noah Kent
Sponsors: Jennifer Abbott (Rhetoric)
Title: How Jason Aldean uses Race as a Rhetorical Function: An Analysis of *Try That in a Small Town*

This rhetorical criticism offers an analysis of *Try That in A Small Town* by Jason Aldean through both the song's lyrics and music video. The analysis delves into the racially connotated themes and stereotypes within the song and video, exposing how they contribute to a white supremacist representation of white rural America. By examining coded language targeting people of color, the critique reveals how Aldean's work perpetuates harmful stereotypes and justifies control over racialized bodies. Aldean also creates a rhetorical border by emphasizing the contrast between rural tranquility and urban violence, which is accomplished through his lyrical choices. The deliberate choice of imagery, including law enforcement proceedings and racially charged scenes, is scrutinized for reinforcing biased perspectives and neglecting the struggles faced by Black bodies. Overall, the song and music video are critiqued for relying on racially charged elements that hinder progress toward a more egalitarian society.

Presenters: James Szalkie
Sponsors: James Brown (Physics)
Title: Imaging Sound Waves in Translucent Materials

The field of geophysics often relies on the invisible in order to research the intricate composition of our earth, or even extraterrestrial bodies. This includes mainly sound waves, derived from seismic activity, in order to deduce what exists beneath our feet. However, light has proven to be a much more reliable source of imaging, as it has a smaller scale to its behavior and can be manipulated in ways much different from sound. Using light waves to image sound waves, we can hope to better understand the relationship between sound and different materials in real time, and create new systems to catalogue these movements. Future applications can include better mining practices, architecture, land surveying, and carbon recapture.

Presenters: Joseph Barnett
Sponsors: Nicholas Snow (Philosophy, Politics, & Economics)
Title: In Defense of Dollar Stores: A Closer Look into the Relationship between Dollar Stores and Consumers

The dollar store industry is witnessing rapid growth, attracting attention from mass media and policymakers who often view its expansion as detrimental to local communities. This paper explores the dollar store phenomenon through the lens of behavioral economics, challenging traditional theories that posit irrational decision-making. Drawing from literature critiquing behavioral economic approaches, the paper contests the prevailing narrative that dollar stores harm consumers and contribute to food deserts. By examining consumer preferences, overall food abundance, and costs, the paper asserts that the market-driven growth of dollar stores aligns with consumer demands. The paper scrutinizes common concerns surrounding dollar stores, such as their impact on local businesses and potential health consequences, offering an alternative perspective rooted in consumer rationality. The analysis contributes to the ongoing discourse on policymaking aimed at influencing consumer choices and challenges the prevailing negative perception of dollar stores in public discourse. While acknowledging existing health concerns, the paper calls for cautious policymaking, emphasizing the importance of preserving consumer choice and market dynamics.

Oral Presentations & Performances

Presenters: Matthew Jessup
Sponsors: Eric Dunaway (Economics)
Title: Trading on AI Insights: Evaluating Forex Predictions from Central Bank Statements

My research objective is to explore AI's capability, specifically OpenAI's GPT4, to make accurate forex market trade predictions based on monetary policy statements from the G10 Central Banks. This group represents the world's most traded foreign currency exchange markets.

Using a backtesting methodology, I deployed GPT4 to interpret the nuances within each policy statement and predict currency pair movements, such as the EUR/USD forex pair, when comparing the US Federal Reserve with the European Central Bank. GPT4's role as a currency trader involved classifying the policy stance of each bank and making a trade recommendation. These recommendations were tested against historical price data to gauge profitability.

The backtest yielded a remarkable 65-70% success rate in profitable trade predictions, suggesting the potential for AI to significantly impact financial trading markets. This study underscores AI's transformative potential within the currency trading and broader investment sphere.

Despite successful backtesting, it's important to recognize that past performance may not predict future results.

Presenters: Matthew Lepper
Sponsors: Bradley Carlson (Biology)
Title: Effects of Rhizobial Diversity on Soybean Health

Soybeans utilize rhizobial bacteria in their soil to fix atmospheric nitrogen, converting it into a form of nitrogen that is crucial for plant growth and development. The rhizobial bacteria live in nodules that form on the roots of the soybeans, with higher nodule counts being linked to greater overall production of soybeans, which is desirable for the current agricultural market (Nakei et al, 2022). In the experimental gardens at the Smithsonian Environmental Research Center, we are introducing different combinations of bacteria cultures into the soil of both GMO and Heirloom soybean varieties. This will demonstrate whether or not different levels of rhizobial bacteria diversity in the soil of soybeans will affect overall growth and productivity of both GMO and Heirloom varieties.

We found a handful of statistically significant results regarding different metrics taken over the experiment. Our phenology data was graphed as the mean number of days it took to reach a reproductive stage, and we found significant differences in presence/absence of rhizobia in Heirloom varieties, a significant type difference (GMO v Heirloom), and significant diversity difference within the Heirloom varieties. We also found statistically significant data within our relative chlorophyll content metric (SPAD). Within SPAD, we found a significant presence/absence difference between both GMO and Heirloom varieties, but no overall diversity effect. For non-photochemical quenching (NPQt), we found significant differences in presence/absence for both types, and a significant difference in diversity by type. For overall plant height, we found a significant presence/absence effect between both types. Finally, for insect damage percentages we found significant diversity effects for the Heirloom varieties.

Oral Presentations & Performances

Presenters: Owen Bennett
Sponsors: Noe Pliego Campos (History)
Title: Reconstructing Henry S. Lane: Redefining Political Legacy Amidst Reconstruction Ambiguity

This paper investigates the role of Henry S. Lane in Reconstruction politics and how it challenges traditional historiography by investigating political speeches and actions during this controversial time in American history. While many scholars focused on Lane's early political career and involvement in the nomination of Abraham Lincoln as a Republican candidate for the 1860 presidential nomination, a historical ambiguity, or gap, forms as traditional narratives conclude the senator's political career in 1865, despite his ending in March 1867. This gap in the historical narration of Lane's life obscures the senator's final push to mend the societal wounds caused by the American Civil War and create a nation that firmly stands by its founding promises of "life, liberty, and pursuit of happiness." His involvement in the Freedmen's Bureau Bill of 1865 and 1866, the Civil Rights Bill of 1866, and the February 8th, 1866, Congressional speech titled "Reconstruction and Amendments to the Constitution" frames Lane as an active contributor to Reconstruction politics. Lane's dedication to the implementation of civil rights and advocacy to hold the South accountable for their treasonous actions toward the United States serves as a case study to view the complexity of the Reconstruction Era through the eyes of a Southern-born, Northern politician.

Presenters: Preston Reynolds & Logan Weilbaker
Sponsors: Zachery Koppelman (Writing Center)
Title: A More Perfect Writing Center

How do relationships shape our lives? This philosophical question unpredictably arose while walking the streets of Athens in the Spring of 2023. A simple exchange of ideas between Wabash College's Writing Center and the American College of Greece's Student Academic Support Services (SASS) evolved into a revaluation of the role of personal relationships in the advancement of societal good. Two Writing Consultants (Logan Weilbaker and Preston Reynolds) approached this question in very different ways. Logan Weilbaker will be presenting how the interpersonal relationship between consultant and peer is formative in academic success. Preston Reynolds will present how societal conditions shape academic outcomes and perspectives. Come explore the misadventures of two dashing young students in Greece as they try to unravel how to cultivate the perfect writing center. The Wabash College Writing Center thanks the Stevenson Institute for Classical Liberalism for the opportunity to work abroad.

Presenters: Thomas Oppman
Sponsors: Walter Novak (Chemistry)
Title: Small Ultra Red Fluorescent Protein as a Potential pH Biosensor in Human Cancer Cells

Recent research into the biochemical processes of cancer cells has revealed that dysregulated intracellular pH (pHi) dynamics play a role in cancer development and progression. Cells normally undergo transient changes in pHi in order to regulate molecular processes like protein activity or metabolism. However, dysregulated pHi dynamics in cancer cells enable a variety of cancer-associated cell behaviors – such as cell proliferation, metastasis, or evasion of apoptosis. Most research into pHi dynamics in cancer cells has been on the level of cell populations; in order to obtain single-cell pHi measurements, researchers can utilize genetically encoded pH-sensitive fluorescent protein biosensors. Ideally, these pHi biosensors would be non-aggregating within cells, show high photostability and brightness, and can be imaged with deep cell penetrance (excitation wavelengths >630 nm). This presentation outlines initial research characterizing Small Ultra Red Fluorescent Protein (smURFP) as an engineering starting point to develop an improved pH biosensor for use in human cancer cells. smURFP is bright, photostable, emits in the far-red visible range, and expresses well in *E. coli*. Through multiple experimental approaches using nigericin as an ionophore to manipulate pHi in both *E. coli* and human cancer cells, it is shown that smURFP has little to no inherent pH sensitivity. Additionally, this research demonstrates methods used to improve the health of smURFP-expressing cells via supplementation of biliverdin, a smURFP fluorescence cofactor. Future work will generate a library of smURFP mutants to screen for pH-sensitive variants of this bright and photostable small fluorescent protein.

Oral Presentations & Performances

Presenters: Zachary Geleott & John Mills
Sponsors: Michele Pittard (Education Studies)
Title: *Wabash Always Fights*: The Unintended Side Effects of our Mantra

Competitiveness and achievement are often considered catalysts for success, yet what transpires when the burden becomes overwhelming? In the *Wise Wallies* podcast, we take a deeper look into the minds of Wabash men as we question our school's mantra *Wabash Always Fights* - something that has, at times, been misconstrued. While America has adopted a nuanced approach to mental health, there appears to be a tendency for men to be overlooked and shrouded in the shadows. As the prospective leaders of America, it is imperative for us to shed light on the very tangible and inevitable mental health challenges that men may encounter. At Wabash, we aim to proactively address these issues and pave the way forward. We are a school rooted in tradition, but is it time for us to rethink and alter something as big as our mantra?

Presenters: Zev Wolverton
Sponsors: Michele Pittard (Education Studies)
Title: Rediscovering Chapel Sing

Rediscovering Chapel Sing is a podcast about the important history of chapel sing, highlights the old traditions and the weight of chapel sing as a tradition for Wabash and the individual benefit on mental health. Includes interviews from a Freshman, Junior, and a Senior on their experience before and after chapel sing. The podcast includes ideas on a revised chapel sing tradition that is able to further involve each freshman in the tradition based on the former chapel sing tradition from 1960's to the 1980's. The podcast includes concepts discussed in the book *Comfort Crisis* by Micheal Easter to further enhance the importance of chapel sing as a tradition at Wabash and how it is the start line for most students to begin to feel like a true Wabash Man.

Poster Presentations & Exhibitions (Alphabetical by Presenter)

Presenters: Alex Amore & Eric Green
Sponsors: Joe Scanlon (Chemistry)
Title: Molecular Rotors Encapsulated in a Palladium Chloride Coordinated Hexagonal Macrocyclic Framework

Molecular machines are a relatively new concept in Chemistry. They have applications in many areas of chemistry. Molecular rotors are a type of molecular machine that involves rotation along an axis. Our experimental collaborators have synthesized a number of these molecular rotors with different aromatic structures in the center of each hexagonal framework. Our computational work has aimed to investigate the rotational ability of the central ring and what conformations are lowest in energy.

Our computational methods included using WebMO and Gaussian, to create potential energy surface plots and minima for each species of palladium chloride coordination hexagonal macrocyclic frameworks. Lowest energy conformations were done with optimizing calculations that find optimal positions of the central ring. To create potential energy surfaces we defined a dihedral angle as 1 and systematically froze this angle as increasing intervals and calculating the energy at each step. In most species there were two symmetric positions for the central ring that were identified as minima. Additionally, the smallest central ring, benzene, could rotate freely but larger central rings only rotate up to ~180 degrees before an energy barrier restricted rotation.

Presenters: Alexander Worley, Yuma Ozaki, & Reese May
Sponsors: Colin McKinney & Qixin Deng (Mathematics & Computer Science)
Title: Senior Capstone Game Demo

The presentation is of a game demo, created by three students, during CSC-400 (Senior Capstone for the Computer Science major). This presentation will include gameplay of the game, along with details about the game's development towards the final product. The development team consisted of three titles, such as World-development, Character-Development, and UI/UX Development. The presentation will briefly go with aspects such as the game engine used and how each team member achieved their goal. There will also be an interactive experience with the game, as attendees will be able to play the game first-hand to see how the game functions and provide feedback.

Presenters: Andrew Sinkovics & Phenix Carney
Sponsors: Matthew Greenhalgh (Spanish)
Title: Léanme: Spanish Children's Literature

Our research from Léanme: Spanish Children's Literature frames the economic and health outcomes related to access to literature at a young age. For this project, we focus on access to children's literature in Spanish and outcomes directly related to children who primarily speak Spanish. Specifically, we investigated the community of Crawfordsville to understand the local implications of access to this literature. Research was conducted and data collected pertaining to the content, quality, and quantity of the Crawfordsville Public Library's collection of children's literature in Spanish, as well as local statistics provided by Crawfordsville Elementary School to analyze this data. Our research from this project suggests the importance of reading as an adolescent for obtaining positive health and economic outcomes.

Poster Presentations & Exhibitions

Presenters: Arman Luthra
Sponsors: Nicholas Snow (Philosophy, Politics, and Economics)
Title: Exploring the Dynamics of Transnational Financial flows through Computational Linguistics: Forecasting Remittance Patterns among the Indian Diaspora in Canada

The presentation will explore the potential of integrating natural language processing (NLP) techniques with time series modeling to improve predictions of transnational financial flows, taking remittance inflows to India as a case study. My research employs a mixed methods approach combining quantitative SARIMA time series modeling with qualitative sentiment analysis of news articles related to the Indian diaspora and remittances. An initial SARIMA(1,2,1)(1,1,1,12) model yielded a high mean absolute percentage error (MAPE) of 62.96% for remittance forecasts. To enhance accuracy, sentiment scores derived from NLP analysis of 1000 news articles were incorporated as adjustment factors into the SARIMA model. This integration dramatically improved the MAPE to 6.25%, highlighting the benefits of overlaying NLP-based qualitative factors onto statistical forecasting models. The research demonstrates the value of an inter-disciplinary approach combining computational linguistics and econometrics to create more robust predictions of complex financial flows. It opens up new possibilities for integrating textual data analytics into financial forecasting.

Presenters: Artie Rogers, Cole Borden, & Evan Kanetkar
Sponsors: Colin McKinney & Qixin Deng (Mathematics & Computer Science)
Title: ACE NBA MVP Prediction Rating Application

This project involves the development of a comprehensive NBA player analysis system with a user-friendly front end. The system utilizes web scraping techniques to gather player statistics from basketball-reference.com, employing custom-weighted metrics to evaluate player performance across various categories such as field goals, rebounds, assists, and more. The back end, implemented in Python, processes and analyzes the data, generating a unique metric called ACE (Artie Cole Evan) to rank players. Furthermore, the project includes a dynamic front-end interface that allows users to interact with and visualize the analyzed data, facilitating an intuitive exploration of top-performing NBA players. This integrated system provides a holistic view of player contributions, enhancing the accessibility and interpretability of basketball analytics for enthusiasts and analysts alike.

Presenters: Augustus Isaac
Sponsors: Walter Novak (Chemistry) & Erika Sorensen-Kamakian (Biology)
Title: Prokaryotic Puppetry: Mastering the Art of Bacterial Degradation with LOCKR

Balancing protein production and removal is essential across lifeforms because it maintains the health and life of both individual cells and the organism itself. Manipulation of protein levels in disease-causing bacteria may hold the key to creating novel alternatives to traditional antibiotics. Short protein sequences called degrons signal for protein removal using proteases, enzymes that breakdown proteins. The Latching Orthogonal Key and Cage pRotein system (LOCKR) consists of a designed bioactive protein switch, where the bioactive sequence is a degron (degronLOCKR). Importantly, degronLOCKR only signals for protein removal in the presence of an inducible Key. The application of degronLOCKR in prokaryotes remains unexplored. This study will adapt the eukaryotic degronLOCKR to control protein removal in bacteria. We modified the LOCKR system to include a bacterial *ssrA* degron sequence (bacdegronLOCKR) and fused it to a green fluorescent protein (GFP). Pilot experiments using bacdegronLOCKR in *E. coli* revealed removal of proteins upon Key induction, as evidenced by reduced GFP fluorescence. Our efforts aim to optimize the bacdegronLOCKR system to regulate protein removal in bacteria. We anticipate the bacdegronLOCKR could have the ability to manipulate bacterial proteins in a variety of ways, offering an innovative tool for novel degron-based antibiotics.

Poster Presentations & Exhibitions

Presenters: Augusto Kern Ghidini
Sponsors: Renee Altergott (French)
Title: The Love for Notre Dame: From Hugo's Famous Novel to Dr. Pardoën's Efforts

This project examines the complex reconstruction process of Notre-Dame Cathedral, also known as Our Lady of Paris, after the sorrowful fire that occurred in April of 2019. Due to its deep significance in a historical, cultural, and religious sphere not only to France, but also to the world, no efforts have been spared so that the reconstruction of the “spirit of Paris” is finished as quickly as possible, which is predicted to happen by 2024. In this project, I analyze the process of restoring the acoustic properties of the cathedral, which requires detailed attention and research, because the reverberation of the sounds in the interior of a cathedral is susceptible to change due to minimal physical changes - it is such a complex and delicate work. To better understand the restoration of the cathedral's soundscape, some classmates and I conducted an interview in French with Dr. Mylène Pardoën, the leading French soundscape archaeologist working on Notre-Dame. The project also touches on the significance of Notre-Dame Cathedral in the XIX century, through the lens of Victor Hugo who wrote *The Hunchback of Notre Dame* in 1831 with a similar goal of preserving it from destruction.

Presenters: Ayden Lutes, Alex Amore, Patrick Countryman, & Eric Green
Sponsors: Joe Scanlon (Chemistry)
Title: Potential Energy Surfaces of Hexagonal Macrocycles

Being able to design and synthesize molecular machines is a long-standing goal of chemistry. Molecular rotors are a subclass of molecular machines that have a rotating element. The molecular rotors could have applications in drug delivery, molecular electronics, and other fields. Our experimental collaborators have been able to synthesize hexagonal silver coordinated macrocycles with high yield and purity. These macrocycles contain a central rod with a ring that has the possibility to rotate. The goal of this project is to determine the position of the central ring relative to the macrocycle and whether the central ring can freely rotate.

We used computational chemistry, including two programs WebMO and Gaussian, to study these macrocycles. We performed optimization calculations to determine stable positions of the central ring. We also systematically froze the ring at increasing angles with respect to the macrocycle and calculated the energy to create a rotational potential energy surface where the relative energy was graphed against the angle. We found that the central ring preferred two symmetric positions with respect to the macrocycle. The smallest central ring (benzene) was found to rotate freely, but larger rings could only rotate ~180 degrees before the energy rose too high.

Presenters: Benjamin Casica-Patton
Sponsors: Renee Altergott (French)
Title: Underwater Soundscapes: Exploring Debussy's *La Cathédrale Engloutie*

This presentation explores Claude Debussy's artistic manipulation of sound in crafting a captivating musical narrative that transports the audience to the mythical City of Ys. *La cathédrale engloutie* is an example of musical Impressionism, a style which seeks to evoke emotions and atmospheres through subtle and innovative use of harmony, texture, and timbre. An analysis of the score will be undertaken, unraveling the unconventional techniques Debussy employed to achieve these Impressionistic qualities. We'll also immerse ourselves in the enchanting melodies of Debussy's piano piece, examining various recordings that bring to life the vivid world he conjures through his composition. One such recording is of Debussy himself playing, providing us unique insight into how the composer envisioned the piece's interpretation.

Poster Presentations & Exhibitions

Presenters: Bernardo Morales
Sponsors: Nathan Tompkins (Physics)
Title: Rocketry: Designing and Testing a Rocket

The field of rocketry constitutes a complex boundary in engineering, requiring the careful incorporation of a collection of safety protocols and data acquisition procedures to ensure the success of a launch attempt. Designing, developing, and evaluating rockets is facilitated by utilizing a custom electronic circuitry platform and applying comprehension of aerodynamics. Investigating various aerodynamic principles enables an insightful analysis of design choices, thereby facilitating the formulation of a dynamically stable and safe rocket. Furthermore, using simulation data from the Open-Rocket platform enables a proximate analysis, presenting an exemplar rocket marked by its ability to provide significant information, encompassing elements such as location, altitude, speed, and other relevant parameters.

Presenters: Bryan Cherry & Aiden Orcutt
Sponsors: Nathan Tompkins (Physics)
Title: Analyzing Precipitate Membrane Growth with Varying Current Utilizing Microfluidics

Microfluidics is the study of fluid flow in microscale systems. In this system fluid flows into channels where it forms a precipitate from a chemical reaction. Microfluidics is a rapidly emerging technology that finds applications in a diverse range of STEM fields. In the posters we will discuss three things: the electric potential of a precipitation reaction is measured in a microfluidic device, the growth rate over time, and then the precipitate membrane growth over time with varying the voltage.

Presenters: Christan Zimmerman & Luke Davis
Sponsors: Annah Kalb (Chemistry)
Title: Photoredox Catalysis with Organic Photocatalysts

Acyl radical chemistry is a relatively new and exciting field that could eventually play a role in pharmaceutical development and the synthesis of otherwise unachievable products. Photoredox catalysis, which involves the formation of radical species using visible light, is an attractive approach for the formation of these acyl radicals, which can be used to create new carbon-carbon bonds. This research focused largely on the synthesis of phenyl phenothiazine derivatives that could be used in place of organometallic photoredox catalysts. The various derivatives were tested as photocatalysts under identical reaction conditions and the products were examined via ^1H NMR. Optimization is underway to maximize percent yield by analyzing effects of different stir times, LED colors, and solvents. Future testing, more broadly, could help permit more cost-effective pathways to synthesize various products using acyl radicals that may hold a wide range of chemical benefits.

Presenters: Christan Zimmerman, Zephaniah Johnson, & Jackson Bohrer
Sponsors: Neil Schmitzer-Torbert (Psychology)
Title: Impact of Awe Induction on Creativity

A relationship has been shown previously that awe could enhance creative thinking, which is a positively regarded trait in academia and the professional world. The current study examined the effects of awe induction on creativity and attempted to replicate the finding that awe induction expanded the perception of time availability. While the induction of awe was successful along with the replication of the finding that awe induction expands the perception of time availability in Experiment 1, there was no significant relationship between awe induction and creativity. A second experiment was completed with a baseline measure of creativity, a measure of dispositional positive emotions, and an altered final measurement of creativity. This experiment failed to induce awe and therefore was inconclusive regarding its impact on creativity. Strategies were discussed to improve further experimentation such as modifying the method of awe induction and restructuring the measure of creativity. Overall, the potential of awe induction and other emotions should be explored further, as they could have impactful future implications in inducing creative thinking and other positive traits.

Poster Presentations & Exhibitions

Presenters: Connor Craig
Sponsors: Elan Pavlinich (English)
Title: Mitigating Black Maternal Mortality Health Disparities

One of the United States' contemporary public health concerns is addressing the health disparity between the Black maternal mortality rate and other racial and ethnic counterparts. The CDC has determined that all maternal mortality rates have grown since 2000 and Black mothers are dying from birth more often than any other race or ethnicity. The source of this issue is based on systemic racial injustices and surrounding issues found within the social determinants of health. This research aims to evaluate the public health aspects of the overall epidemiology and explain some potential solutions to help provide equitable care to Black mothers through applied feminist methodologies and anecdotes to expose the racial injustices impacting the medical field. My standpoint as a white, cisgender straight male, pre-medicine student attending Wabash College means that I have a limited perspective, and this research is intended to help my understanding of what Black mothers experience during the birthing process and pre/-post-natal care so I can do my part to contribute towards a solution gaining overall equitable healthcare access.

Presenters: Drake Hayes, Owen Runge, & Kazi Fardinul Hoque
Sponsors: Colin McKinney & Qixin Deng (Mathematics & Computer Science)
Title: Machine Learning-Based Vacation Recommender

Have you ever wanted to take a vacation but felt indecisive about where to go? With the advent of AI, we have seen an uptick in the number of machine learning-based recommenders. A quick scroll through Netflix, YouTube, or Spotify will reveal a plethora of for-you movies, videos, and songs. But, while such recommenders for movies and songs abound, those that provide tailored vacation recommendations are lacking. Thus, in our project, we set out to develop a machine learning algorithm capable of generating vacation recommendations based on user inputs.

Presenters: Dalton Kuhn & Eero Gross
Sponsors: Heidi Walsh (Biology)
Title: Quantifying Intracellular Calcium to Better Understand Endoplasmic Reticulum Stress and Lipotoxicity

Calcium is an important intracellular signal whose homeostasis within cells is tightly regulated. Calcium homeostasis is disrupted in both endoplasmic reticulum stress (due to protein misfolding) and lipotoxicity, a condition where excess lipids trigger apoptotic signaling. Our project focused on developing techniques to reliably detect and quantify intracellular calcium in a human kidney cell line (HEK293T) and a mouse neuronal cell line (GT1-7). After confirming that ER stress (induced by thapsigargin or tunicamycin) and lipotoxicity (induced by the saturated fatty acid palmitic acid) caused cell death, we tested BrightER, a fluorescent ER stain, as well as genetically-encoded calcium sensors for optical imaging targeted to the ER, mitochondria, and cytosol. GECOs expressed well in HEK293T cells and changes in GECO fluorescence, which correlate with calcium levels, were detectable using microscopy and a fluorescent plate reader. Future work will focus on optimizing GECO expression in GT1-7 cells using lentiviral transduction.

Poster Presentations & Exhibitions

Presenters: Gavin Hill
Sponsors: Huei-Jyun Ye (Political Science)
Title: Food Deserts and Political Participation

This study explores how living in food deserts, areas with limited access to nutritious food affecting millions of Americans, relates to political participation. It questions how this scarcity might influence civic engagement, considering varying viewpoints—whether proximity to food sources directly affects political involvement or if other factors play a more significant role.

Examining data linking food deserts to voter turnout across counties, this research seeks to uncover the complex relationship between food access and political engagement in the U.S. It aims to reveal unexpected patterns that challenge established assumptions, highlighting the potential impact of food accessibility on civic dynamics and political participation.

Presenters: Henry Giesel
Sponsors: Erika Sorensen-Kamakian (Biology) & Walter Novak (Chemistry)
Title: The Effects of Notch Signaling on Fusion

In animals, cells communicate to respond to the environment, regulate development, and to accomplish organismal tasks. Notch signaling is a conserved communication pathway that is found in all animals and when perturbed, can cause a variety of cancers. One important gene central to Notch signaling is *sel-8*, a transcription factor necessary for development, including vulva formation (egg-laying apparatus) and the production of sperm and eggs (gametes). *eff-1* is a cell fusogen known to be repressed by Notch signaling in the digestive system. Fusogens mediate cell–cell fusion which is critical for the merging of eggs and sperm and in organ development. Few fusogens have been identified in humans, necessitating their study in simpler animals like the worm *C. elegans*. We aim to study the relationship between *sel-8* and *eff-1* and hypothesize that *sel-8* prevents *eff-1* expression during gamete and vulval development. We predicted that depletion of both genes would result in *eff-1* phenotypes only (epistasis). We genetically engineered bacteria to deplete each gene individually and simultaneously using RNA interference. We observed that animals with both genes depleted had sterile and embryonic lethality phenotypes most like animals with *eff-1* depletion only, which partially supports our hypothesis. This study suggests that Notch signaling may play an important role in regulating fusogen expression during gamete development in *C. elegans* and potentially in other animals, including humans.

Presenters: Jacob Lawson
Sponsors: Heidi Walsh (Biology)
Title: Investigating the Role of Inositol Trisphosphate Receptors in Endoplasmic Reticulum Stress Responses

Endoplasmic reticulum (ER) stress occurs when the protein folding capacity of the ER is exceeded. Multiple stimuli can lead to ER stress, including inflammation, oxidative stress, and excess lipids. Previous work in our lab demonstrated that the saturated fatty acid palmitic acid activates the cellular response to ER stress known as the unfolded protein response (UPR). Calcium homeostasis within the ER is crucial to its protein folding capacity, and one of the main ways calcium leaves this organelle is through the opening of inositol trisphosphate (IP3) receptors that act as gated calcium channels on the ER membrane. We recently showed that blockade of IP3 receptors with the drug 2-APB prevented activation of a UPR-luciferase reporter gene. Xbp1 is a transcription factor activated by the UPR that helps resolve ER stress by increasing the expression of chaperone proteins. Currently, we are determining whether 2-APB changes the mRNA splicing of Xbp1 after thapsigargin or palmitic acid treatment, as splicing is necessary to form an active Xbp1 protein. We also hope to measure activation of other UPR components to determine if other branches of the UPR rely on the release of ER calcium via IP3 receptors.

Poster Presentations & Exhibitions

Presenters: Jerry Little, William Boswell, & Jordan Carter
Sponsors: Walter Novak (Chemistry) & Erika Sorensen-Kamakian (Biology)
Title: Taking Out the Trash: Developing a Protein Degradation Assay for LOCKR

Degrans are protein sequences that signal protein degradation, and are important to shape the gene expression landscape in living organisms. The Latching Orthogonal Cage/Key pRoteins system uses degrons (degron-LOCKR) to regulate protein degradation. Degron-LOCKR has a Switch with a degron in an “off” state that can be “unlocked” by a protein Key. When the degron is “unlocked” by the Key, it evokes degradation of the Switch and any attached proteins. We seek to optimize LOCKR to control protein degradation in *C. elegans*. We initially designed a fluorescence-based assay where the Switch was fused to red fluorescent protein (RFP-Switch). In the presence of Key, we predicted that red fluorescence would decrease over time. We failed to detect protein degradation in this experiment. We hypothesized that this result could be from either 1) failure to obtain full-length RFP-Switch or 2) technical issues with the assay. To overcome the first problem, we transformed the RFP-Switch into a new cell line. To test the second possibility, we utilized a Western blot experiment. Using Western blotting, we found that Switch degrades almost instantaneously after Key is added. These results suggest that we will need to modify the fluorescence-based assay to account for the rapid degradation seen under current conditions.

Presenters: John Schnerre
Sponsors: Patrick Burton (Biology)
Title: Proper Blastema Formation Requires Innervation in *Aeolosoma* (*Annelida*)

Calcium channels are vital to neural signaling, specifically in the release of neurotransmitters from axon terminals. In invertebrates, N-type calcium channels assist in neural signaling. Invertebrate calcium-activated chloride channels affect ion transport across cell membranes and help regulate cell homeostasis as well as neural signaling capacity (Wang et al. 2013). *Aeolosoma* is a freshwater annelid capable of complete regeneration when bisected. We tested whether an N-type Calcium Channel inhibitor and a calcium-activated chloride channel inhibitor would have on cell proliferation and neural regeneration. We found that both inhibitors limited the success of regeneration and had a variety of non-normal effects of neural regeneration.

Presenters: Joshua Manfred & Corbin Strimel
Sponsors: Karen Gunther (Psychology)
Title: Kandinsky was Right: Few do “Express Bright Yellow in the Bass Notes, or Dark Lake in the Treble”

Cross-modal correspondence is a sense of the inherent belongingness between two different senses; in our study these were pitch and color. Our goal was to investigate the confound in previous literature of individual differences in color brightness and pitch loudness. We tested twenty male participants. We determined equal brightness for each participant, across six colors: red, orange, yellow, green, blue, and purple; and equal loudness across seven pitches: 125, 250, 500, 2000, 4000, 8000, and 12,500 Hz. Then participants matched pitch with color in three different conditions: prototypical color hues, gray scale, and isobright colors. Our results indicated that in the prototypical condition, the participants chose yellow for high pitches, and blue and purple for the lowest pitches. In the gray scale condition, they chose white for high pitches and black for low pitches. These findings are consistent with previous research in the literature. However, we found that when controlling for individual differences in brightness, participants still chose yellow with higher pitches. Thus, there appears to be an inherent sense of belongingness between yellow and high pitches, even when controlling for the confounds of individual differences in brightness and loudness.

Poster Presentations & Exhibitions

Presenters: Justin Lewis
Sponsors: Bradley Carlson (Biology)
Title: Testing for Top-Down Ecological Effects of Eastern Box Turtles

Turtles and tortoises are among the most threatened groups of animals and may play important ecological roles. The Eastern Box Turtle (*Terrapene c. carolina*) is in decline, yet little is known about its effects within its ecological community. This research aims to test for effects of box turtles on vegetation in their habitat and behavioral patterns of favored prey (three species of terrestrial snails). We created exclusion pens in a forest occupied by box turtles to measure the effect of turtle herbivory over a span of two years. Initial results suggest no differences in plant density or species richness between exclusion, control, and reference plots. This may be because of low turtle densities and low rates of feeding on vegetation. This experiment will be extended to produce a larger dataset. To see whether box turtles affect the behavior patterns of terrestrial snails, we ran two laboratory experiments with land snails. First, we tested snail climbing behavior in response to filter paper saturated with water and different combination of scents, including box turtle, injured conspecifics (crushed snails), and a reptile that is not a natural predator of land snails (*Pantherophis spiloides*). Next, we conducted a choice experiment where snails could select to spend time on filter paper wetted with water or with combinations of scents listed above. Results for this study are forthcoming and will be reported.

Presenters: Luis Rivera
Sponsors: Karen Gunther (Psychology)
Title: Political Affiliation Affects Spoken Language Processing

We studied to what extent political affiliation affects listeners' perception of native and non-native speech when controlling for participant location (urban vs. rural). A previous study conducted by the Acoustics, Phonetics, and Perception Lab at NYU showed that people who considered themselves more conservative were worse at speech intelligibility tasks than those who were more liberal. However, they did not control for location, which tends to predict exposure to accented speech. We therefore conducted our study in two different areas with Prolific: in urban NYC and in a handful of rural states (ND, SD, WY, ID, MT). Our results for the urban group showed that even when controlling for location, people who are more conservative are worse at completing speech intelligibility tasks, which suggests that political affiliation does have an impact on spoken language processing.

Presenters: Matthew Jessup
Sponsors: Joyce Burnette (Economics)
Title: Evaluating Racial Bias in AI Language Models

As AI models like ChatGPT become more prevalent in industries, my study investigates whether they replicate the racial biases often found in human decisions. This research examines ten AI models that are given the role of job recruiters, evaluating six resumes with nearly identical qualifications that differ only in the applicants' names, suggestive of Hispanic, Black, or White ethnic groups.

Each AI model scores the resumes on a 0-10 scale. The initial findings reveal varying levels of bias; some AIs show substantial bias, while others demonstrate little to none. Incorporating the latter could help reduce racial prejudice in hiring. My research not only uncovers potential biases in AI but also offers insights into promoting fair AI use in the job market.

Poster Presentations & Exhibitions

Presenters: Nhan Huynh
Sponsors: Walter Novak (Chemistry) & Erika Sorensen-Kamakian (Biology)
Title: Drug-Resistant Melanoma is Mediated by DNA Damage

Melanoma is the most threatening type of skin cancer, as it has high potential for developing metastasis resulting in poor patient outcomes. In the lab, the presence of mGluR1 or metabotropic glutamate receptor 1 is able to induce melanoma tumor formation. When glutamate binds to mGluR1, it activates internal cell signaling pathways, resulting in high proliferation rates and reduced cell death (glutamatergic signaling). Troriluzole is able to inhibit glutamatergic signaling by decreasing the glutamate levels outside of the melanoma cells, preventing tumor growth. However, in treated mice, we observed resistance to troriluzole drug treatment. Therefore, the current project aims to discover how troriluzole resistance is mediated. We hypothesize that resistance is caused by either DNA damage or oxidative homeostasis. We found elevated levels of DNA damage in drug-resistant animals. One possibility is that enhanced DNA damage causes mutations that promote cell proliferation. Future experiments will test this possibility.

Presenters: Reece Bauer
Sponsors: Joyce Burnette (Economics)
Title: Wage Discrepancies: Examining the Wage Gap Between United States Born Citizens and Immigrants

The purpose of this research is to analyze the wage gap between United States born citizens and immigrants who reside here, and provide a further understanding as to why there is a gap. I am analyzing past research done by Chiswick (1978), Enchautegui (1998), and Bleakley and Chin (2004), and I am expanding upon their findings. I analyze the annual wage gap between immigrants and U.S. born citizens in 2010 and 2020. Immigration numbers continue to play a role on the United States Economy. Within this research, I further provide evidence to show why the wage gap has shrunk across the 10-year span. Using data from The Integrated Public Use Microdata Series (IPUMS USA), I collected similar variables to past researchers mentioned to break down the trends. I observed that the gap has shrunk by over 10% across the 10-year span, and I additionally found that an immigrant's educational attainment is starting to push them ahead. In 2010, immigrants lnwage was less on average compared to U.S. born citizens across all educational groups. In 2020, immigrants with a college degree had a predicted lnwage of 11.21 compared to 11.15 of U.S. born citizens. Immigrants have benefited in many ways across the years, but we must note that the categories that were most detrimental to them in 2010 are no longer hurting them as much.

Presenters: Seth Acero
Sponsors: Elan Pavlinich (English)
Title: Layers of Desire: Exploring Aggression, Objectification, and Male Receptiveness in Pornography

This presentation seeks to examine pornography and the consequences that fall within the industry that has attracted billions to their sites for the sake of pleasure. Because of how mainstream and accessible pornography has become to the general public, there has been severe consequences that affect men and women in the form of addiction, objectification, and aggression. The presentation brings forth information about male consumption of pornography, which starts at the age of 8 and progresses until the late 30s, skewing the perception of what "real sex" looks like and allowing young men to view porn as education, not a fantasy. This brings in the topic of objectification and aggression, as most pornography displays a male fantasy that features themes that sexualize rape, coercion, objectification, and torture. This, mixed in with the average age of porn consumers, has led to an increase in aggression towards women, as more teens that have watched or tried something they saw in porn were more likely to commit or be a victim of dating violence. Furthermore, most rape cases across the world mimic scenes that the perpetrator saw in pornography.

Poster Presentations & Exhibitions

Presenters: Taylor Lorsung
Sponsors: Patrick Burton (Biology)
Title: Lonafarnib and Dizocilpine Inhibits Annelid *Aeolosoma* Regeneration

Aeolosoma, a remarkable freshwater annelid, exhibits exceptional regenerative capabilities, successfully restoring missing structures within 120 hours post-bisection. This study investigates the impact of two chemicals, Lonafarnib and Dizocilpine, on the regenerative processes in *Aeolosoma*. Lonafarnib targets H-Ras, K-Ras-4B, and N-Ras, while Dizocilpine targets N-methyl-D-aspartate (NMDA). Both chemicals are implicated in inhibiting cell proliferation, a crucial aspect of *Aeolosoma*'s regenerative ability (Chen et al., 2019).

Presenters: Thomas Oppman, Precious Ainabor, Nathanael Mertz, Cole Shifferly, & Andrew Sinkovics
Sponsors: Walter Novak (Chemistry) & Erika Sorensen-Kamakian (Biology)
Title: De'feeting' Barriers to Binding: An Analysis of Toeholds in LOCKR

Latching Orthogonal Cage Key Proteins (LOCKR) uses protein switches with bioactive peptides that can modulate gene expression, alter signaling pathways, control protein-protein interactions, or degrade proteins in cells. One component of this system is the Latch, which contains the bioactive peptide that is integrated into the Cage. In this state, the bioactive sequence is locked in the “off” state. Upon the addition of a Key protein, the Key unlocks the Latch from the Cage thus turning “on” its bioactive peptide for biological function. Because the Key-Cage interaction determines biological function, understanding what strengthens or weakens this interaction is critical. One factor that influences this interaction is the length of the toehold, which shortens the Latch relative to the Cage. Our research goal is to generate Latches with different toeholds and to identify which toehold variants bind Key best. To do this, we used molecular biology to create different Latch toeholds, expressed these proteins, and tagged them with a fluorescent molecule. We hypothesize that small toeholds will always be “off”, while larger toeholds will always be “on.” Our preliminary experiments show differences in Key binding based on Latch toehold length; further research will reveal the optimal toehold length for LOCKR.

Presenters: Troy Brown & Samer Halabi
Sponsors: Anne Bost (Biology)
Title: Broad Spectrum Antimicrobial Properties of a Wabash Field Isolate

Multidrug resistant bacteria are an ongoing public health threat. Wabash is doing our part to combat this problem by screening unique soil niches to discover novel antimicrobials. Recently our lab discovered an interesting candidate in a *Pseudomonas* bacterial strain isolated from the soil beside the back stairs of the new Wabash College football field. Similar to other *Pseudomonas* strains, the Wabash version inhibits *Mycobacterium smegmatis* and *Staphylococcus epidermidis* which are model systems for the drug resistant organisms that cause tuberculosis (*Mycobacterium tuberculosis*) and MRSA (*Staphylococcus aureus*). Interestingly the Wabash *Pseudomonas* strain also inhibits *Serratia marcescens*—to our knowledge the first demonstration of this effect. Pathogenic *Serratia* species are among the World Health Organization's multidrug resistant Priority Pathogens and are particularly problematic in hospital acquired infections of neonates and immunocompromised patients. Our data suggest that *Pseudomonas*-based therapeutics may hold promise in the fight against *Serratia* disease.

Poster Presentations & Exhibitions

Presenters: William Keeling & Mason Naaman
Sponsors: Erika Sorensen-Kamakian (Biology) & Walter Novak (Chemistry)
Title: Appetite for Destruction: Purification of the 26S Proteasome in *C. elegans*

Gene inactivation helps scientists better understand the role of that gene in normal development and the development of disease. The ‘Latching Orthogonal Cage–Key pRoteins’ (LOCKR) technology provides a novel way to inactivate genes by destroying a gene’s protein product. LOCKR uses designed Switches that signal for protein destruction using a molecular machine called the proteasome when attached to a protein of interest. To date, Switches have successfully induced protein destruction in yeast and cell culture, but are currently untested in an animal model. Thus, we seek to optimize the LOCKR Switch for use in the worm *C. elegans*. To this end, we first set out to isolate the *C. elegans* proteasome using two techniques: 1) affinity purification of following CRISPR-Cas9 modification and 2) ion-exchange and hydrophobic interaction chromatography. For affinity purification, we designed gRNAs to add a C-terminal 3xFLAG tag by CRISPR-Cas9 modification to three distinct components in the proteasome (*rpn-1*, *rpn-1*, and *pbs-4*). We also report our initial experiments to isolate the 26S proteasome from *C. elegans* using chromatography. We anticipate that isolated proteasome will be useful to optimize LOCKR Switches and in future experiments that explore gene inactivation in *C. elegans*.

