Beloit College Student Research Symposium, April 16, 2020

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	Jamie Gabrielle Lepito, Coco Charles	Predictive Model for High School Student Sense of Belonging
	Zhen Li	Advanced Synthesis of Barcoded Beads in High-throughput scRNA-seq
	Morgan Lippert	“Nothing Servile”: Exploring Cultural Preservation and Native Resistance at the Santee Normal Training School
	María Elvira López	Single Strikes for the Future: Climate Activism in Moscow
	Eli McGraw	Autonomy and Sense-Making: Clarifying the Individual in Social Cognition
	Will Mertens	What’s Wrong With the West (?): How lifestyle Migration Shaped the Spiritual Tourism Industry in Ubud, Bali
	Fiona R Milchman	Affirming Identity and Supporting Student Success Through Dual Language Immersion
	Hengchun Mu	How to Transform Slowly Converging Series into Rapidly Converging Series
	YJ Na	Learning From the Experience: Overcoming Failure and Deconstructing the Issues of the Tourism Industry
	Olivia Nasatir	Race and Gender Discrimination in the Treatment of Immigrants at Angel Island
	Olivia Nasatir	Evaluation of Forensic Evidence by Potential Jurors
	Phuc (Jerry) Ngo	Hasse-Minkowski Theorem for Quadratic Forms in Two and Three Variables
	Anusha Pahari	Behavior of Loons in Response to Predators
	Laura Quintero	History of Pirates in the Virgin Islands
	Kerry Randazzo	Slow Fashion Beloit: Sustainable Clothing Use through Sewing Education
	Simone Rawal	Exploring how accelerated changes in land use and anthropogenic biomes affect carbon output
	Andrew Rich	Taphonomy and Biodiversity of Fish Fossils from the Middle Devonian Milwaukee Formation
	Philippe Rollet	Constraining the depositional environment of Triassic Halite from the Röt Basin, Netherlands
	Kaveri Sarkar	Cross-Cultural Differences in the Effectiveness of 12 Happiness-Inducing Techniques
	Kaveri Sarkar	Role of religion in narratives of nationhood and the rising tensions between Hindus and Muslims in India
	Benjamin Scott	Blood-brain barrier spheroids and 3D-printed perfusable chips as in vitro screening platforms for brain-penetrating agents
	Colleen Marie Tillis	Identifying Visual Spatial Weakness in Geometry Students
	Sophia Townsend	Leaving Suburbia: an examination of white escapism in punk music
	Ha H Truong	Human Activity Classification Using Smartphone Sensors

	Jiho Wu, Olivia Brimacombe	Labor Market Effects on High School Graduation Rates in the US
	Tianzi Zhao	Sex education: Beliefs and Practices–A Case Study of China, USA and Sweden

Abstracts

Sponsor: Tawnya Cary

Link to Presentation

Victoria Angeles '20

Chicago, Illinois

Major: Biology

Investigating Susceptibility of Tadpoles to Ranavirus (FV3) with Exposure to Polychlorinated Biphenyl

Amphibian populations have declined dramatically in many areas of the world, and environmental pollution is one factor implicated in these declines. The polychlorinated biphenyl-126 (PCB-126) is a legacy environmental pollutant known to cause immune disruption, which could lead to increased vulnerability to disease. We tested whether *Lithobates pipiens* tadpoles exposed to polychlorinated biphenyl (PCB-126) would have increased susceptibility to a ranavirus, Frog Virus 3 (FV3). As an indicator of susceptibility, we measured morphometrics of exposed tadpoles, because infected tadpoles would have to allocate energy to fighting the infection instead of growth. We predicted that the growth of the tadpoles would decrease if exposed to both PCB and FV3. Additionally, we needed to determine whether or not the tadpoles were actually infected with the ranavirus. We extracted DNA from the kidneys of preserved tadpoles and used polymerase chain reaction (PCR) and gel electrophoresis to identify FV3 DNA in the kidneys. There were no differences in any growth parameters or organ mass ratios measured between our PCB-treated and PCB + FV3-treated tadpoles. However, there was a change in intestinal length compared to control for PCB + FV3 treated tadpoles. As the amount of FV3 virus increased, there was a decrease in intestinal length for both control and PCB. We also only found FV3 DNA in three of our FV3-exposed tadpoles. At this time, we are unable to conclude whether or not PCB exposure increased tadpole susceptibility to FV3.

Sponsor: Beatrice McKenzie

Link to Presentation

Margaret Baugh '22

St. Louis, Missouri

Majors: History; Critical Identities Studies

Who Threw the First Brick: The Myth of the Stonewall Riots

The Stonewall Riots have been mythologized in the fifty years since the riot took place. Without being formally taught, people theorize about who started the riots, why the riots started, and how monumental they were. I conducted interviews with nonexperts on their knowledge of Stonewall, finding that the events have become oversimplified into a narrative that I refer to as “the Stonewall myth.” I then compared this myth to museum exhibits, primary sources, and historians’ retellings. Additionally, I used the new theory of mnemohistory to analyze how myths are created from a combination of memory and history. This symposium presentation analyzes my findings, examining the true and false elements of the myth and how the myth formed.

Sponsor: Pablo Toral

Link to Presentation

Emeline Brady '20

Chicago, Illinois

Major: Environmental Justice & Citizenship
Minor: Political Science

Under Illinois Skies: The Importance of Access to Outdoor Recreation for Inner-City Youth

Over the past two summers I was a nature camp counselor for the Chicago Park District’s “Under Illinois Skies” program. The goal of the program is to get inner-city kids outside and provide them access to outdoor environments. Because being outside improves children’s development, well-being and positive attitudes towards the environment, this program is essential to the campers’ growth and to preventing what researchers are beginning to refer to as "Nature Deficit Disorder." The idea refers to the increasing physical and cognitive changes being seen, particularly with children, that indicate serious consequences from a lack of outdoor

exposure. Essentially, kids are losing valuable lessons and connections that typically occur outside, such as risk-taking, creativity development, conflict resolution, and more.

Though on the whole a great program, there will always be room for the U.I.S. camp to improve. Currently there is a need for more environmental education experience from counselors. In addition, there should be more catering to our audience with regards to students of color and low-income families, and goals should be established with the campers early on in the program.

By providing young people with opportunities to explore and learn about their environments, programs like Under Illinois Skies highlight the major impacts outdoor recreation and education have for adolescents' healthy development. This overall growth can be found from watching students light up when they recognize specific flora & fauna to trying new activities, such as cooking and kayaking. My research and experiences show how access to nature should be a right, because interacting with nature profoundly changes us for the better.

Sponsor: Diep Phan

Link to Presentation

Olivia Brimacombe '20 — London, UK

Major: International Political Economics
Minor: Chinese (Mandarin)

Jiho Wu '20 — Seoul, Korea

Majors: Quantitative Economics; Studio Art

Labor Market Effects on High School Graduation Rates in the US

Do lower unemployment rates and higher minimum wages decrease the high school graduation rate? We analyze how high school graduation rate is affected by the labor market, economy, education policy and expenditure, legislature control, and population composition with a state fixed-effects model. Our results provide no support that better labor market conditions influence students' decision to drop out and work.

Sponsor: Eyad Said

Link to Presentation

Coco Charles '20 — Madison, Connecticut

Major: Computer Science

Jamie Gabrielle Lepito '20 — Avon, Connecticut

Major: Computer Science
Minors: Journalism; Political Science

Predictive Model for High School Student Sense of Belonging

High school is both a difficult and transformative time for adolescents. A sense of belonging is essential for a student's well being. It can affect many aspects of their lives, from their mental health to their academic achievement. School administrators, unsure of which students are most likely to feel unwelcome, often struggle to address this problem.

In our research, we use machine learning to develop classification models for predicting a student's feeling of belongingness at their high school. We use a decision tree and support vector machine to determine what attributes correlate with an individual's sense of belonging. Our work is done in the Python coding language using data exploration libraries such as Pandas and Matplotlib.

We use data from the 2018 Dane County Youth Assessment Survey, which surveyed 16,289 students from 19 high schools throughout Dane County, Wisconsin. The survey is conducted every three years and consists of 113 questions asking students about a variety of topics ranging from family life to screen time, with the goal of bringing attention to student concerns and needs. This dataset has been used as insight throughout Dane County for policy decisions, parental awareness, and the work of school boards and agencies designed to help youth. In addition, it has been the basis of various peer reviewed studies regarding LGBTQ+ students, bullying, and substance abuse.

After using the decision tree and support vector machine, we compare them to assess the performance of each. With these results, we determine which model is best suited to identify students who may feel socially isolated. We hope these findings can be used to improve student inclusivity in high schools.

Sponsor: Kristin Labby
Justin Severson (Prochem)

Link to Presentation

Chance Christian '20

Las Vegas, Nevada

Major: Applied Chemistry

Summer Internship at Prochem

Prochem Inc. is a small inorganic chemical manufacturer in Rockford, IL, and is where I spent my summer of 2019 as an intern. As a chemistry major, my courses at Beloit College prepared me for performing chemical reaction calculations and setting up inorganic synthesis reactions efficiently and safely. My internship began with the usage of the classic trigonometric acronym “SOH CAH TOA” in order to adjust a lathe to cut a Teflon block into a stopper for a round bottom flask. Next was the implementation of stoichiometry to calculate the elemental concentrations within the inorganic chemicals such as gallium bromide, copper(II) chloride, cobalt(III) oxide, and others through titration to meet the specifications of the customer’s request.

After these two written trials, my ability to blow scientific glassware came in handy as glass rods needed to be manipulated into stirrers. Next, the chemists and I engaged in hands-on work by moving, mixing, and reacting kilogram mass quantities of inorganic compounds together by manipulating pressure and temperature to push the reactions forward. The results of these syntheses are not only the chemical product, but the reaction vessel that needs to be hand washed with potent nitric and hydrofluoric acid.

The amount of physical labor that goes into performing these tasks stressed the importance of pacing time within a work environment. Communication was also a factor in the efficiency of the manufacturing process, as the workers performed unique steps within the synthesis of one product. The Prochem internship experience included many tasks that are beneficial for individuals who are pursuing a future in the chemical manufacturing industry.

Sponsor: Tawnya Cary

Link to Presentation

Rachel Cook '20

Moscow, Idaho

Major: Ecology, Evolution, and Behavioral Biology

Amplification of Ranavirus DNA from Infected Tadpole Tissues

Amphibian populations worldwide have been declining in recent years due to increasing instances of disease, anthropogenic pollution and habitat destruction, or a combination thereof. Frog virus 3 (FV3), a type of ranavirus, has been found to cause infection in many species of amphibians worldwide and has resulted in die-offs in wild populations. Building off work performed by Angeles in 2018, the goal of this project was to amplify FV3 DNA from *Lithobates pipiens* tadpoles that had been orally exposed to both FV3 and polychlorinated biphenyl-126 (PCB-126), an environmental pollutant known to increase amphibian susceptibility to disease. DNA was extracted from tadpole liver and kidney tissues and amplification of FV3 DNA was performed using polymerase chain reactions (PCRs) with FV3 primers. The PCR products were then visualized using gel electrophoresis. The results of the PCRs were variable, with amplification of FV3 DNA occurring in the kidney tissue of some, but not all, of the tadpoles exposed to FV3. Consistent viral DNA amplification from the exposed tissue samples is important in confirming infection with FV3 and drawing conclusions about the effect of environmental pollutants on FV3 infection. Continued analysis of the samples would provide a more comprehensive understanding of whether all the tadpoles exposed to FV3 were infected with FV3.

Sponsor: Tamara Ketabgian

Link to Presentation

Griffin Cross '21

Arvada, Colorado

Majors: Literary Studies; Creative Writing
Minor: Spanish

Voices Reconstructed: A Creative Audio Project

June 1872. Charles Plainview has invented the world's first speaking machine. Listen to his daily recordings and understand the fear and exhilaration that new technology inspired during the Second Industrial Revolution.

"The Fantograph" is a creative audio project I made in the style of the found footage genre. This 10-minute feature is the culmination of what I learned from Tamara Ketabgian's Victorian and Neo-Victorian Literature course. I will share clips from "The Fantograph" and analyze the making of it, which felt more like an adventure than an assignment.

I hope to inspire others to explore what it must have been like to live during the advent of the many technologies that surround us today.

Special thanks to Claire Hayes, who made this project what it is.

Sponsor: George Lisensky

Link to Presentation

Fabian Dauzvardis '20

Erie, Colorado

Majors: Chemistry; Physics

Synthesis of Naturally Inspired Superhydrophobic Surfaces Using Copper Nanoparticles

Cicadae, butterflies, darkling beetles, flower petals, and especially the lotus leaf all have evolved to repel water abnormally well. This property originates from the structure that these organisms have on the scale of a nanometer (a thousandth of a thousandth of a thousandth of a meter). This research takes knowledge of these structures and replicates the chemistry and the physics necessary to simply produce superhydrophobic surfaces. Half of a zinc substrate has copper nanoparticles electrolessly deposited onto its surface. Coating this with a non-polar alkanethiol will make the surface superhydrophobic.

Sponsor: Tamara Ketabgian

Link to Presentation

Julia Dirkes-Jacks '20

Evanston, Illinois

Majors: Literary Studies; Creative Writing; Theatre Production; Theatre Performance

Leading Ladies: Children's Literature through the Lens of American Girl

This project looks at how the genre of Children's Literature has changed over the past forty years, using the American Girl books as a critical lens. Initially I planned for this project to have a creative component where a group of actors and I would travel to local elementary schools and public libraries and perform a live short play based on American Girl stories. However, this element of the project was made impossible by school closures resulting from the COVID-19 outbreak. I will discuss how the American Girl brand has remained on the cutting edge of four key areas that are also important within the broader genre of children's literature: diversity/inclusivity, values, marketing, and the tangible extension of story through material objects that allow for children to engage in creative play (in the case of American Girl, their line of dolls, accessories, and other toys).

My presentation will discuss conclusions that I have drawn through interviews with experts in the field and an analysis of literary criticism, American Girl novels, and other works of Children's Literature from the past four decades. Although the live performance aspect of my project will have to be tabled for the time being, I am hopeful that I can pursue it in the future.

Sponsor: Tamara Ketabgian

Link to Presentation

Geneva Duren '20

Davis, California

Major: Creative Writing

Not Here to Make Friends: A Creative Project

This project explores a creative world where non-powered superheroes and supervillains compete on a Bachelor in Paradise-style reality show in the hopes of finding their perfect nemeses. I focus almost entirely on different aspects of evil in female characters and why it continues to fascinate readers, writers, and viewers. From the evil Femme Fatale to the Perky Female Minion, I'll examine established female villain tropes and their subversion. Why is badness particularly interesting, and what does it mean for a woman to be bad? Can a woman be bad the same way a man can? And why do lesbians like villains so much?

In my symposium, I'll tackle these questions from a critical perspective and explain their significance to a broader community audience. Then, I'll invite my audience to take copies of my writing home with them and to draw their own conclusions about my ideas.

Here is the link to my short story "CRIME NIGHT": https://docs.google.com/document/d/1BZzjf7CE70xLbA3_YvYSCbxn7bsDHs7x2jd5zXBtNFU/edit

Here is the link to my short story "BODIES IN SPACE": https://docs.google.com/document/d/1oS-StMB93N3d_GwXrIicum3sHZig-JeGsHBU_JSodRw/edit

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Sponsor: Catherine Orr

Link to Presentation

Ruby Green '20

Portland, Oregon

Majors: Critical Identity Studies; Economics

L'Origine du Monde: Personal Grooming and Desirability

My symposium presentation will go into depth about the research I have done exploring the concepts of personal grooming and desirability, specifically focused on pubic hair grooming. I will be discussing the results of a survey I have conducted that asks about individuals' experiences with personal grooming and its impact on their sexual lives. This survey also asks various demographic questions that will help me to determine if people of different political leanings, religions, levels of education, ages, and sexualities think about pubic hair grooming differently. I will also examine what other researchers have found about pubic hair and look at it from a variety of perspectives and topics, including health, feminism, pornography, the infantilization of women, and the sexualization of the teenage female body. I will also look at cultural and religious differences surrounding pubic hair grooming, such as the Islamic concept of fitrah and Brazil's long history of pubic hair shaving and waxing. My presentation hopes to shed some light on a part of human existence that is often overlooked and is very dependent on one's social and cultural experiences.

Sponsor: Beatrice McKenzie

Link to Presentation

Kaija Groom '20

Brooklyn, New York

Major: History
Minor: Religious Studies

Operation Pedro Pan: Cuban Children's Experience of Alienation, Race, and Transnational Identity in the Cold War United States

My research investigates the experiences of assimilation among unaccompanied Cuban children who were brought to the United States through Operation Pedro Pan. Operation Pedro Pan was a U.S. government, CIA, and Catholic Welfare Bureau backed operation that resulted in 14,048 unaccompanied Cuban children being airlifted from Cuba to the U.S. between 1960 and 1962. The operation was a result of Cold War tensions and of the inherent politicalization of children.

The Cuban government's efforts to control children and to make them a central part of the revolution, along with U.S. government agencies' involvement in propaganda, led to the politicalization of children and Operation Pedro Pan.

In this paper I use the theories of alienation and transnationalism to examine the experiences of Pedro Pan children's assimilation into the U.S., and I argue Cuban children who migrated to the U.S. through Operation Pedro Pan became trapped in a cycle of alienation in which they struggled to establish their identities as both Cubans and Americans. Furthermore, I argue that race both allowed for Cuban children to be admitted into the U.S. and amplified their alienation.

The research for and writing of this paper was completed in Fall 2019, within the context of "Advanced Topics in Immigration History," a history capstone taught by Beatrice McKenzie. This paper was written in the context of today's treatment of Latin American child immigrants and is meant to encourage readers to compare the experiences of Pedro Pans with the experiences of modern day child immigrants from Latin America.

Sponsor: Natalie Gummer

Link to Presentation

Hana Roz Hassanpourgol '20

McAllen, Texas

Major: Religious Studies

Not all Flesh is Sacred: Sexualized Piety and the Muslim Body

How have Western subscriptions to sexuality disrupted the veil's sacrality? Scholars, activists, religious leaders, and journalists alike have all tried to make sense of the Islamic headscarf's position in the contemporary world in which we live, which is one of rampant contention between the religious and the secular, the sacred from the profane, East and West, the agent and the agent-less, and so on. These particular binaries illustrate a rather intimate relationship between the domineering white and Western hegemony that prevails over not just the internal lives but also the physical bodies and flesh—often referred to as "colonized bodies"—that exist under such conditions. I am arguing that the ability to perform piety through veiling has become obstructed by way of sensory and epistemic tensions between East and West, flesh and gaze, sacrality and sin. To demonstrate this point, I queer the veil and its accompanying flesh through an examination of its role in pornography as popularized by the Lebanese-American adult film star Mia Khalifa in 2015.

Sponsor: Mehmet Dik

Link to Presentation

Thai Nam Hoang '23

Ho Chi Minh City, Vietnam

Major: Computer Science

Predicting total Covid-19 infected cases using mathematical approach

The Nonlinear Grey Bernoulli Model NGBM(1,1) is a recently developed grey model that has various applications in different fields, mainly due to its accuracy in handling small time-series datasets with non-linear variations. In this paper, to fully improve the accuracy of this model, a novel model is proposed, namely Rolling Optimized Nonlinear Grey Bernoulli Model RONGBM(1,1). This model combines the rolling mechanism with the simultaneous optimization of all model parameters (exponential, background value and initial condition). The accuracy of this new model is significantly confirmed by forecasting Vietnam's GDP from 2013 to 2018 before it is applied to predict the total COVID-19 infected cases globally by day.

Sponsor: James Rougvie

Link to Presentation

Sophia Hopp '20

Chicago, Illinois

Major: Environmental Geology

Sodic-Calcic Alteration at the White Rock Pluton: Constraining Fluid Sources with Oxygen Isotopes

Rocks on the eastern margin of Whiterock Pluton (29 Ma) in the southwestern Elk Mountains, have been locally affected by sodic-calcic metasomatism due to the flow of moderate to high salinity fluid along joints and fractures. In this process, sodium and calcium were added to the rock at the expense of other elements. This form of alteration is widespread in contact aureoles and is commonly associated with iron oxide copper gold deposits (IOGs) and iron oxide apatite deposits (IOAs). Mineral samples taken from the Whiterock Pluton, and surrounding country rock, were analyzed for oxygen isotopes to determine the source of altering fluid. The alteration cuts across grandorite and Maroon Formation metasedimentary rocks, and occurs across several zones of varying intensity of alteration. Some igneous plagioclase persists through the alteration zones, but much was replaced by metasomatic Na feldspar. Alteration products include titanite and albitized feldspar, which are present in the most altered zones. The oxygen isotopic compositions of several minerals in these zones have been analyzed to constrain the origin of the alteration fluids. The $\delta^{18}O$ of a mineral is a function of the mineral's fractionation factors, the $\delta^{18}O$ of the altering fluid, and temperature.

Based on these new mineral data, $\delta^{18}O$ values of water in equilibrium with these samples fall within the range for normal igneous-derived fluids (+6 ‰ to +10 ‰) for a range of alteration temperatures. Previous studies of the Whiterock Pluton have shown evidence for meteoric water sourced alteration. This particular alteration zone seems to be dominated by igneous fluid, and suggests inhomogeneous fluid sources at the scale of the contact aureole.

Sponsor: Pablo Toral

Link to Presentation

Yanwen Huang '21

Hunan, China

Majors: Political Science; Business Economics

Communication as a Public Health Instrument in the Midst of the Covid-19 Pandemic: Lessons from China

This presentation is based on my senior thesis, which examines the communication strategy of China's government during the Covid-19 health crisis. My project grew out of my own personal experience. I learned about the outbreak at a very early stage, before the Chinese media officially reported on it, and communicated it to my family and friends in China via social media. They did not take me seriously, as they had not yet read reports of the outbreak in the Chinese media. My mom only bought masks reluctantly upon my insistence. This made me realize the important role that the media play in the midst of a pandemic as tools of education and public health policy. My thesis tries to explain the government's communication strategy during health crises by looking at three different case studies (the Henan blood scandal in the 1990s, the spread of SARS in 2003, and the ongoing Covid-19 epidemic.) It concludes that one of the government's top priorities was to maintain social stability in the midst of each health crisis by engaging in information management, especially through social media, and appeals to nationalism. Data came from media reports in official Chinese media as well as interviews.

Sponsor: Tamara Ketabgian

Link to Presentation

Adrian Hughes '21

Herndon, Virginia

Major: Philosophy, Creative Writing

Spotify as a Language: Virtual Interaction in the Age of Quarantine

I once used the popular music streaming app Spotify to listen to songs I like and find new music, but now I use it for much more than that. This project explores how Spotify can serve as a communication platform, exchanging songs and playlists instead of words or images. Complicated romances and drama have unfolded only on Spotify between myself and a few other users, as we don't interact outside of the app. Maybe if we did, this form of interaction never would have developed. I have discovered Spotify to support a language of emotion expressed in music, its meaning situated in timing and context. I've never felt closer to another person than I have on Spotify. It can be easier to express a feeling by playing a song than to have a conversation about it. I've also never felt so lonely, trapped in a computer without a body, sharing emotions with someone I can't see or

speak to. In my presentation, I will tell my story of what can happen on Spotify. It's a story of uncertainty and unexpected human expression in a time of interactions mediated by technology, especially now due to quarantine that all interactions are virtual.

Sponsor: Marina Bergenstock

Link to Presentation

Stacey Jaeger '21

Lisbon, Iowa

Majors: Theatre Performance; Theatre Production
Minor: History

Using Any Resource to Your Advantage through Measurement: a New Theatrical Work

"Measurement: an experiment in love and physics" is a new play written by Jonathan Salem Baskin. The play follows a historical fiction of Albert Michelson, Nobel-winning physicist from the turn of the 20th century, who discovered the truth of the ether, an idea that the world is connected through an invisible force. The play uses a variety of original music to tell the story of what is and what could be.

I was asked to do this by my friend, Abby Bender, who found this play through a community of those interested in the intersection of science and theater and asked for my assistance directing it due to my musical knowledge. We met with Jonathan and wanted to perform this for Beloit to create a great link for the science and theatre students. We spent most of our time in discussion with each other, Jonathan, and the cast of students. New works take so much effort: rewrites, workshopping, meetings, paperwork, outreach, and rehearsals from the first write to the final script of a fully realized production. We wanted to get Jonathan a few steps closer to that realization. To aid with this, we agreed to bring our Beloit production to Chicago to get potential producers to see the work.

With new works, the point is to create something that the audience has never seen or experienced before. It takes so many people with a passion for the project and the drive to work long and hard on it to really create something special. Creating something that becomes professional takes many years and hundreds of people working on it. In this digital age, it becomes easier to share all the gradual steps to get to that professional production, so any and all resources that are available become priceless.

Sponsor: Eyad Said

Link to Presentation

Prince John '22

Bhopal, India

Major: undeclared

Employing Data Mining Techniques on Biomedical Voice Measurements to Predict Parkinson's Disease

Parkinson's disease is a degenerative brain disorder which usually presents symptoms like stiffness, body tremors, and difficulty maintaining balance and coordination. The symptoms get worse with age and usually start developing around 60 years of age.

There is currently no way to diagnose Parkinson's using blood or laboratory tests for non-genetic cases[1]. Diagnoses are done using patients' medical history and neurological exams. It is important to diagnose Parkinson's early, due to very similar symptoms it has to other diseases which require different treatments.

In this project, I employ data mining and machine learning techniques to analyse the Parkinson's data set generously donated by Max Little of the University of Oxford to the public domain. The data set was used to train an artificial neural network to classify the likelihood of having Parkinson's disease based on the speech patterns.

The dataset has been created with biomedical voice measurements from 31 different people, 23 having Parkinson's. In total it has about 200 instances of voice recordings. The final data set does not contain any actual audio recordings. Each sound sample has been processed into 22 discrete attributes such as average

fundamental frequency, % jitter, and several other measures of vocal variations.

(1) "Parkinson's Disease Information Page". NINDS. 30 June 2016

Sponsor: Charles Westerberg

Link to Presentation

Mason Jones '20

Santa Maria, California

Major: Sociology
Minor: Law and Justice

Ironies of the Foster Care System: Safety and Stigma

There has been little qualitative sociological research that focuses on how foster care workers view the system that they are working in. The study made use of in depth interviews of foster care workers to gauge the degree to which foster care workers see the system as over reliant on bureaucracy and a moral conceptual system that focuses on authority, discipline, and punishment. The interviews demonstrated that the foster care workers expressed recognition for the need for bureaucracy and rules to keep children safe. However, they also reported several examples of how too much bureaucracy leads to increased stigma for children in the system. Workers called for a more balanced approach focusing on nurturance as well as discipline. Workers concluded that one way of doing this is to build upon the "Reasonable and Prudent Parenting Standard," allowing older youth who gain more autonomy within the system to have more opportunities for age and developmentally-appropriate activities and experiences that allow children and youth to grow.

Sponsor: Catherine Orr

Link to Presentation

Ana A. Kohout '21

Lake Forest, Illinois

Majors: Education & Youth Studies; Disability Studies

A Place for Us : A Project For Rising Disability Activists

I will present on how A Place For Us, a national student led organization that is still a work in progress, aims to unify disability rights activists in colleges across the country. We empower self-advocates with disabilities in high school, educate the broader community on disability justice, and develop plans to close the gap between academia and activism. The founders of the organization are all undergraduates in colleges or universities across the nation with various disabilities who seek to create a space where they can share their experiences, knowledge, and support for disability justice with high school and college-aged, optimistic disability activists like themselves.

A Place For Us will address the fact that only eleven percent of people with disabilities are enrolled in undergraduate colleges and of those only five percent graduate college. Many students with disabilities do not know their rights or how to advocate for them because disability activism is barely visible in higher education. Too often, people with disabilities are made to feel like there is no place for them in higher education. A Place For Us wants to create that space of belonging, learning, and activism.

Sponsor: Theodore Gries
Jason Kwan (UW Madison)

Link to Presentation

Michael Jones Lafayette '20

Madison, Wisconsin

Majors: Chemistry; Health & Society

Isolation of antimicrobial component from bacteria strain found in Alaskan soil used to fight late blight in potatoes

Researchers are always on the lookout for new molecules with antimicrobial properties. Upon determining that a bacterial strain found in cold Alaskan soil displayed several types of antimicrobial activity, a USDA-funded project was launched to isolate the molecules produced by the bacteria that had the antibiotic capabilities. While this research project is still on-going, my presentation will focus on the isolation of natural products from a crude

bacterial culture. This work involved collaboration between microbiologists and chemists, and I will speak on the interdisciplinary nature of this research environment. In addition to discussing my methods and contributions for this research, I will touch on how having this experience benefited me as a Beloit College chemistry student.

Sponsor: Jingjing Lou

Link to Presentation

Linh Anh Le '20

Hanoi, Vietnam

Majors: Education and Youth Studies; Quantitative Economics

Mother's education and the determinants of child mortality in Vietnam: Evidence from Demographics and Health Survey in 2005

Since the Doi Moi reform in 1986 that transformed Vietnam from a centralized economy to a more market-oriented one, there have been drastic changes to the healthcare system in Vietnam. According to the data from UNICEF's report in 2012 called Maternal, Newborn & Child Survival, Vietnam witnessed a great decrease in child mortality from 51.4 deaths per 1000 live births in 1990 to only 25.1 in 2005. At the same time, the continuous advocacy for investment in education as an investment in economic development has led to the increase in the education attainment of both males and females of all grade levels. Given this correlation, this study explores the factors that determine child mortality that women from 15 to 49 years old experienced in Vietnam. Using the data from the Vietnam Demographics and Health Survey in 2005, this study reveals important findings about the predicted mortality of infants and children under five years old through William Brass's method. In addition, the findings deepen the knowledge about whether having a highly educated mother increases the chance of survival of the child, which could support policies improving gender equality and equity in education access. Last, this paper includes some determinants such as demographics, wealth, ethnicity and knowledge about sexually transmitted diseases to investigate the inequality that women with different backgrounds had experienced which possibly led to child mortality.

Sponsor: Eyad Said

Link to Presentation

Jamie Gabrielle Lepito '20

Avon, Connecticut

Major: Computer Science
Minors: Journalism; Political Science

Coco Charles '20

Madison, Connecticut

Major: Computer Science

Predictive Model for High School Student Sense of Belonging

High school is both a difficult and transformative time for adolescents. A sense of belonging is essential for a student's well being. It can affect many aspects of their lives, from their mental health to their academic achievement. School administrators, unsure of which students are most likely to feel unwelcome, often struggle to address this problem.

In our research, we use machine learning to develop classification models for predicting a student's feeling of belongingness at their high school. We use a decision tree and support vector machine to determine what attributes correlate with an individual's sense of belonging. Our work is done in the Python coding language using data exploration libraries such as Pandas and Matplotlib.

We use data from the 2018 Dane County Youth Assessment Survey, which surveyed 16,289 students from 19 high schools throughout Dane County, Wisconsin. The survey is conducted every three years and consists of 113 questions asking students about a variety of topics ranging from family life to screen time, with the goal of bringing attention to student concerns and needs. This dataset has been used as insight throughout Dane County for policy decisions, parental awareness, school boards, and agencies designed to help youth. In addition, it has been the basis of various peer reviewed studies regarding LGBTQ+ students, bullying, and substance abuse.

After using the decision tree and support vector machine, we compare them to assess the performance of each. With these results, we determine which model is best suited to identify students who may feel socially isolated. We hope these findings can be used to improve student inclusivity in high schools.

Sponsor: Rachel Bergstrom

Link to Presentation

Zhen Li '20

Nanjing, China

Majors: Biology; Cognitive Science

Advanced Synthesis of Barcoded Beads in High-throughput scRNA-seq

Due to the increasing needs of human genome study, research in high-throughput and low-cost scRNA-seq platform has been pushed further to the forefront. Instead of averaging the results of multiple cells via traditional cell sequencing, single-cell RNA sequencing could narrow down the result to single-cell mutation and provide us explicit details for further bioinformatics analysis, especially for cancer diagnosis. Despite the fact that previous research has mainly been done with the streptavidin-coated beads and hydrosol-based beads, magnetic beads coated with carboxyl groups were chosen for further synthesis due to their outstanding high-temperature resistance and PCR stability. Even though ligation-based barcoding synthesis has been the most popular synthesis method, it has reached its bottleneck in the past few years. In order to achieve a higher cDNA capture efficiency, this research tries to improve the ligation-based synthesis with extension-based synthesis methodology via three rounds of split-pool synthesis. Reverse complement oligo FAM coated with fluorescence was applied to the research product for further quality checks. Such methodology provides us a higher resolution of cellular differences and a better understanding of the function of an individual cell in the context of its microenvironment.

Sponsor: Katherine Johnston

Link to Presentation

Morgan Lippert '21

Williams Bay, Wisconsin

Major: History
Minor: Museum Studies

“Nothing Servile”: Exploring Cultural Preservation and Native Resistance at the Santee Normal Training School

Following the Civil War, the United States government sought to assimilate Native American children through the use of boarding schools. There, all remainders of former tribal life were to be erased, beginning with Native languages. One school, however, did not comply with this federally-mandated cultural erasure. Founded in 1870 by Rev. Alfred Riggs, the Santee Normal Training School decided instead not only to teach its Dakota pupils in their native language but also to publish literature in the Dakota vernacular.

Conducted over two months at the Newberry Library in Chicago this past fall, my research complicates existing notions of the Native American boarding school experience. It was also during this time that, after weeks of poring over newspapers and correspondence, I discovered that the Santee Normal Training School has fascinating connections to Beloit College.

I encourage history and library lovers alike to attend this symposium presentation. Through exploring the remarkable history of the Santee Normal Training School, I will tell a story of resistance and preservation, a story that has once again found its way back to Beloit College.

Sponsor: Robin Zebrowski

Link to Presentation

Eli McGraw '20

Berryville, Virginia

Major: Cognitive Science
Minor: Philosophy

Autonomy and Sense-Making: Clarifying the Individual in Social Cognition

This paper examines the overarching trajectory of the social cognition conversation with particular focus placed upon the use and role of the individual throughout. Traditional theories posit that individuals apply knowledge about their own internal states to something or someone else in order to infer what that person or thing is experiencing. Embodied and enactive approaches pay closer attention to the individual's bodily experience, as well as interaction processes themselves. As more research is done in regards to both traditional (Theory of Mind Theory, Simulation Theory) and contemporary theories (Interaction Theory, Participatory Sense-Making), the role and use of the individual becomes increasingly convoluted. By calling attention to relevant points of agreement, problematic concessions and obvious inconsistencies, this paper aims to shift the conversation towards a more homogeneous use of the individual throughout social cognition. Inconsistent use has led to inconsistent research. With a better defined individual, contemporary theories like Participatory Sense-Making can effectively move beyond the shortcomings of the ongoing discussion.

Sponsor: Jennifer Esperanza

Link to Presentation

Will Mertens '20

Merino, Colorado

Major: Anthropology

What's Wrong With the West (?): How lifestyle Migration Shaped the Spiritual Tourism Industry in Ubud, Bali

My presentation aims to explore the spiritual tourism industry in Ubud, Bali, from an ethnographic lens based on research that took place in Fall 2019. Spiritual tourism refers to travel for the purpose of finding spirituality to improve one's life; it mostly involves westerners traveling to "exotic" places, whom I refer to as lifestyle migrants. I am concerned about who created the spiritual tourism industry and what that means for Ubud's locals. I also explore Ubud's inherent spirituality through the eyes of Balinese and foreigners, arguing that the spiritual tourism industry was created by expats living in Ubud and largely cuts locals out of the industry.

Sponsor: David Segura

Link to Presentation

Fiona R Milchman '20

Chelsea, Vermont

Majors: Education and Youth Studies; Spanish

Affirming Identity and Supporting Student Success Through Dual Language Immersion

As primary and secondary schools in the United States experience significant demographical shifts, educators and educational institutions must adapt to these changes in order to meet the needs of their students. Primary among these changes in demographics is the growing number of native Spanish speakers, many of whom are English Language Learners (ELLs). This project aims to examine best educational practices for these students using Culturally Responsive Pedagogy (CRP) as an analytical framework. Identity and high academic expectations, being core parts of cultural responsiveness, lie at the center of this work. By comparing Dual-Language Immersion (DLI) programs alongside other programs for Spanish speakers and ELLs, one can observe the importance of native language use in affirming students' identities and supporting positive student outcomes. To examine the differences between DLI and other programs, 15+ articles on the topic were reviewed using the framework of CRP. These articles were sorted into two major categories: student identity and student learning outcomes. Generally, this review shows that DLI instruction, as well as similar practices that include the use of both the native language and English, affirm student identity and support success more so than learning structures that focus solely on English. These findings suggest that as educators in the United States attempt to meet the needs of all students, language of instruction must be taken into consideration. Further, DLI should be further explored as a method for affirming language identities and improving student outcomes.

Sponsor: Ranjan Roy

Link to Presentation

Hengchun Mu '20

Changchun, China

Majors: Quantitative Economics; Mathematics

How to Transform Slowly Converging Series into Rapidly Converging Series

The fundamental theorem of calculus states that differentiation and integration are inverse processes. From their definition, a derivative is a limit of difference and a integral is a limit of sum. With the application of theorems, finding derivatives could be as simple as finding integrals. However, finding differences is quite complicated even for a simple polynomial, x^3, that is $(x+1)^3-x^3$. Is there any way to simplify the intensive calculation? The answer is yes.

Starting with proving if each term in a sum can be re-expressed as a difference of consecutive terms, then it can be summed, this presentation will mainly focus on $1/(x^n)$ case. Then it brings up the idea of the Stirling Numbers of the first kind and explain why the Stirling Numbers of the first kind actually matched with the numerators of the expansion of $1/(x^{n+1})$. After verifying the accuracy of expansions with numerical examples, the last step is to test how good the approximations truly are. The approximations will be compared with the results generated from Euler-Maclaurin summation formula. The approximations are actually precise and the first eight decimals match the results.

The idea behind the application of the Stirling Numbers of the first kind is the transformation between difference and sum. After proving the equation that Stirling did not prove, this method will help fellow students or other scholars avoid intensive and time consuming calculations.

Sponsor: Joshua Moore

Link to Presentation

YJ Na '20

Seoul, S. Korea

Major: Health & Society
Minors: Anthropology; Biology

Learning From the Experience: Overcoming Failure and Deconstructing the Issues of the Tourism Industry

With the help of Beloit College's Summer Funding Program, Weissberg Human Rights Grant, International Education Grant, and Martha and Alan Stuz Grant, I was able to take a 24-day trip to Peru during the summer of 2018 in order to conduct research on South American refugees and healthcare. My research goals were: to observe how the refugee crisis in South America is different from other areas of the world; to see how developing nations such as Peru view their responsibilities towards refugees, and to observe how accessible Peruvian healthcare is in comparison to the rest of the world.

Unfortunately, I struggled to gather sufficient data to support my research. Language barriers were the biggest stumbling block, and the unsustainable relationship between the cultural heritage and the tourism industry was still a shock to me despite being regularly exposed to different cultures from a young age and having several experiences abroad. In short, this research was a failure. It was so devastating and embarrassing that it took me an entire two years to analyze and talk about my experiences openly. While this experience was one of the most defeating of my life to this date, I have actually learned a great deal from the experience itself. Through this observational research, I found that the Peruvian economy was mainly constructed around the tourism industry and that it commodifies its own cultures in order to appeal more to the average tourists. The commodification of any culture is problematic because it misrepresents the traditions, values, and heritage of a group of people for the enjoyment of others. Since the time of the project, I have encountered relevant literature to reflect on the topics of failure and that has helped me begin to deconstruct the issues of the tourism industry.

Sponsor: Beatrice McKenzie

Link to Presentation

Olivia Nasatir '20

Oxnard, California

Majors: History; Psychology
Minor: Law and Social Justice

Race and Gender Discrimination in the Treatment of Immigrants at Angel Island

The experiences of women at Angel Island immigration station reveal the discriminatory practices and general sentiment of the United States against women immigrants of color. Angel Island was an immigration station established in 1910 in San Francisco, California. It served as an immigration and deportation facility. After immigrants arrived they would first be separated by race and gender, then undergo a physical examination, and eventually an interrogation before it was decided whether they could enter the United States. The length of time immigrants remained at Angel Island differed between each person. This presentation will examine the experiences and treatment of women at Angel Island Immigration Station from 1910 to 1940.

Gender, race, and class played pivotal roles in how women immigrants were treated at Angel Island Immigration Station. This can be seen through different treatment in the physical spaces that one was able to inhabit at Angel Island, the medical exams immigrants were required to undergo, the interrogation and interview processes, and the amount of time immigrants were forced to remain at Angel Island before being allowed to enter the United States or being deported.

While the majority of immigrants entering Angel Island were Asian, small groups of white immigrants also arrived at Angel Island. Treatment of immigrants differed according to their race, ethnicity, gender, and class. Comparing the treatment of immigrants of different races sheds light on the discriminatory practices of the U.S between 1910-1940. I focus most specifically on the experiences of Chinese and Japanese women. I will also draw on the experiences of European (white) women immigrants who passed through Angel Island. This comparison demonstrates the racial biases against Asian immigrants.

Sponsor: Lawrence T. White

Link to Presentation

Olivia Nasatir '20

Oxnard, California

Majors: Psychology; History
Minor: Law and Social Justice

Evaluation of Forensic Evidence by Potential Jurors

The primary purpose of this study was to examine how potential jurors rate the accuracy of forensic evidence. The secondary purpose was to identity which psychosocial factors, if any, predict potential jurors' views of forensic evidence.

To explore these questions, I recruited 235 participants across the United States using Mechanical Turk, an on-line research platform. Only those qualified to serve as actual jurors were able to participate (at least 18 years old and a U.S. citizen). Each participant responded to a questionnaire that included questions asking how they would rate the accuracy of specific types of forensic evidence, two questions about their trust in science and trust in police, the Belief in Science Scale (Farias, Newheiser, Kahane, & Toledo, 2013), the Perceptions of Police Scale (Nadal & Davidoff, 2015), the Very Short Authoritarianism Scale (Bizumic & Duckitt, 2018), a question about their political ideology, and a series of questions about demographic characteristics.

I discovered that potential jurors, as a group, rated DNA evidence as the most accurate type of evidence (87.1% accurate). The lowest rated evidence was eyewitness testimony from a bystander (52.7% accurate). In descending order of accuracy, potential jurors rated the evidence as follows: DNA evidence, videotape surveillance, fingerprint evidence, hair and fiber evidence, alcohol and drug tests, suspect confession, eyewitness testimony by a police officer, eyewitness testimony by a victim, polygraph test, and eyewitness testimony from a bystander.

Somewhat unexpectedly, one's belief in science, perceptions of police, authoritarianism, and political ideology did not predict how potential jurors rated the accuracy of forensic evidence. However, my data analysis did reveal other patterns within the data. I will discuss the relationships between jurors' demographic characteristics and their responses to specific scales in my presentation.

Sponsor: Mehmet Dik

Link to Presentation

Phuc (Jerry) Ngo '23

Can Tho, Vietnam

Majors: Computer Science; Mathematics

Hasse-Minkowski Theorem for Quadratic Forms in Two and Three Variables

To determine the solvability of equations has been an extended and fundamental study in Mathematics. The local-global principle states two objects are equivalent globally if and only if they are equivalent locally at all places. By applying that principle, the Hasse - Minkowski theorem is able to tell the existence of rational solutions of an equation. This paper will explore the application of the Hasse-Minkowski Theorem for homogeneous quadratic forms in two and three variables using only undergraduate number theory. Some of the necessary proofs and definitions are provided. Moreover, programming codes for the Hasse-Minkowski theorem are also given at the end.

Sponsor: Tawnya Cary
Harlo Hado (Coe College)

Link to Presentation

Anusha Pahari '21

Kathmandu, Nepal

Majors: Ecology, Evolutionary and Behavioral Biology; Anthropology

Behavior of Loons in Response to Predators

Waterfowl birds display a variety of behaviors like making various noises, making postures, diving and swimming. I wanted to investigate whether any of these behaviors are associated with the threat of predators. To test this hypothesis, I did an observational study on the behavioral patterns of common loons (Gavia immer) found in the Low Lake of Northern Minnesota located in the Boundary Waters. I observed the behavioral patterns of loons when they were approached by predators, in this case, humans approaching them in a canoe. I recorded the various calls, postures, diving patterns and the frequency of a swim escape. I observed loons doing the vulture pose and making three calls – the whale note, the tremulum and the yodel. I had seven observations in which a male-female pair had one or two chicks. We also observed one single loon and one male-female pair without chicks. I compared the behavior patterns of the pairs with chicks, the pair without chicks and the single loon to determine anecdotally if any of the behaviors were more prevalent for the loons with chicks as a protective response. I did have a limited amount of data since I collected seven cases of loons who had chicks but only one case each of a single loon and a loon pair who did not have any chicks. The conclusion mostly was that the alarm calls were only made by loons who were partnered up and more so if they had chicks with them, since 100% of loons with chicks made those noises. The postures were seen more frequently in loons with chicks too, since this was found in 5 out of 7 cases. However, the diving time was higher among single loons with it being 31.5 seconds among single loons and 30 seconds average among loons with chicks.

Sponsor: Shannon Fie

Link to Presentation

Laura Quintero '22

Bourbonnais, Illinois

Major: Anthropology

History of Pirates in the Virgin Islands

The history of the United States Virgin Islands is rich with both social and archaeological evidence. Its shores were home to ancient societies such as the Tiano people, who left visible marks in the archaeological record of the Caribbean. Later the islands became the home of various sugar cane plantations, aiding the islands' reputation for the production of rum. The time frame in between these histories, however, is often overlooked. What happened between the genocide of the Tiano people and the enslavement of Africans on the shores of the Virgin Islands? Pirates. Home to various pirate fleets and littered with hideouts and bases, the Virgin Islands was the center of pirate activity within the Caribbean for centuries, so much so that it is said that at one point all the inhabitants of the islands were pirates. This rich historic record is readily available, while the archaeological material more often remains overlooked. The over-sensationalized topic of pirates (especially within the

Caribbean) has led many archaeologists to avoid research into the lives of pirates. Yet, these material remains offer additional depth and understanding to the history of the Virgin Islands and better contextualize the complex lives of pirates in the Caribbean.

Sponsor: Susan Swanson

Link to Presentation

Kerry Randazzo '20

Portland, Maine

Majors: Environmental Studies (Arts and Communications); Theatre Production

Slow Fashion Beloit: Sustainable Clothing Use through Sewing Education

Slow Fashion Beloit is an initiative built on the principles of sustainable and mindful use of the clothes people wear. In a time where clothing is being produced faster than it ever has before, about three fifths of all clothes end up in incinerators within only a year of being made. This means that the clothing industry generates a notable eight percent of the world's emissions annually, making it one of the world's most pollutive. While individuals may not have control over what fast fashion brands choose to do, they can control the relationship they choose to have with the clothing they already own.

The focus of Slow Fashion Beloit is to give people the tools to change their relationship with their clothing through teaching them how to sew. Throughout the first half of the semester, Slow Fashion hosted biweekly sewing education hours and monthly theme-based sewing workshops. Students would drop into the weekly hours and learn skills, such as fixing holes in pants and using a sewing machine. The more specific monthly workshops would teach skills, such as hand-sewing techniques and how to alter clothing, all within the context of how the topics related to sustainability. In the wake of the COVID-19 crisis, these themed workshops were adapted into video tutorials.

Slow Fashion Beloit aims to teach Beloiters how to repair the clothes they love and alter the clothes that no longer inspire them. By doing this, students are able to significantly extend their clothes' lifespan, keep them out of landfills and incinerators, and begin to curb consumption of ecologically harmful fast fashion goods.

Special thanks to Sue Swanson, Susan Rowe, and Brian Morello for their support in realizing this project.

Sponsor: Susan Swanson

Link to Presentation

Simone Rawal '20

Kathmandu, Nepal

Major: Environmental Geology
Minor: Computer Science

Exploring how accelerated changes in land use and anthropogenic biomes affect carbon output

Land use is at the center of one of the most vexing challenges for the coming decades. The consequences of land use change due to the never-ending demands of the world's population has had unintended consequences. Six anthromes are being used to integrate humans into global ecology. They are Settlements, Villages, Croplands, Rangeland, Forests, and Barren Land. Due to India's exponential population growth and Nepal's geographical diversity, these countries have been chosen as the area of study. Five additional Southeast Asian countries are included for comparison.

Carbon emissions as a result of anthropogenic land use over the pre-industrial Holocene may have had a significant impact on the global carbon cycle. To better understand this impact, each of the six anthromes will be assigned with an average carbon output, which will be calculated using ArcGIS. Ranking these anthromes will allow us to investigate the influence of human activities on carbon and land use and further explore questions related to human-induced irreversible changes. Building off of Ruddiman's 'Early Anthropogenic Hypothesis', the aim of this project is to contribute to a better understanding of the role of humans in the Earth's climate system during the Holocene.

Sponsor: James Zambito

Link to Presentation

Andrew Rich '20

Orland Park, Illinois

Major: Geology
Minor: Biology

Taphonomy and Biodiversity of Fish Fossils from the Middle Devonian Milwaukee Formation

The fish fauna of the Devonian (Givetian) Milwaukee Formation in Milwaukee, Wisconsin, has been studied since 1876. However the preservation of these vertebrate fossils and paleoecological structure has not been examined in detail. This project investigates how fish fossils within the Milwaukee Formation were preserved and the biodiversity of this assemblage. This study determined that the preservation of this fossil fish assemblage was directly affected by the typically low energy levels punctuated by storm events and overall low levels of oxygen of the environment of deposition. This is seen by 100% of the fossil specimens represented by disarticulated remains, encrusters on fish plates, and an abundance of syndepositional pyritic replacement of fossils and carbonate matrices. This study found that the fish biodiversity was dominated by the class Placodermi, and Arthrodira and Ptyctidontida are the only distinct placoderms orders present. Furthermore the biodiversity of the Milwaukee Formation appears lower than world-wide trends of fish biodiversity among various other Givetian and Frasnian assemblages. This project contributes to the scientific knowledge surrounding the Milwaukee Formation by enhancing our understanding of the preservation of fish fossils, and by providing information on local and world-wide biodiversity trends in order to better document this important interval of fish evolution.

Sponsor: James Zambito

Link to Presentation

Philippe Rollet '20

Kenosha, Wisconsin

Major: Environmental Geology
Minor: French

Constraining the depositional environment of Triassic Halite from the Röt Basin, Netherlands

This study uses petrography and fluid inclusion analysis to better constrain the depositional environment of Triassic halite samples from the Röt Basin, Netherlands. The studied halite comes from the Twente Rijn-382 core; one sample from 470.5 m (salt A) and another from 425.1 m (Salt D) depth. Previous studies conducting sulfur isotopic analysis indicate the halite was precipitated under marine conditions. However, the core was drilled on the edge of the Röt Basin where marginal marine conditions were likely, and subaerial exposure may have occurred.To better constrain the depositional environment, halite samples were cleaved into thick sections (a few mm thick) and polished with sandpaper; water was not used in order to avoid dissolution of samples. A petrographic microscope was used to look for features indicating shallow water, such as: chevron crystals, dissolution surfaces and pipes formed from influx of rain or normal marine water, and effervescent crusts and desiccation cracks, which show subaerial exposure. A Fluid Inclusion Stage was then used to discern pH by performing freezing/melting runs and comparing phase changes in fluid inclusions to previous studies.

This study found chevron crystals in both halite samples; this bottom-growth crystal form is indicative of shallow water depths (less than 60 cm). The freezing/melting runs showed features indicative of acidic parent brines as noted by previous studies, such as fuzzy borders, building block borders, and low first melt temperatures; however diagnostic features of acid brines like unidentifiable metastable solids and the duration of hydrohalite rims were not observed and/or require further study. These results suggest that the halite studied formed from evolved marine water in shallow water, restricted marginal marine (sabkha) settings.

Sponsor: Lawrence T. White

Link to Presentation

Kaveri Sarkar '20

New Delhi, India

Majors: Psychology; International Relations

Cross-Cultural Differences in the Effectiveness of 12 Happiness-Inducing Techniques

My interests in positive psychology and cross-cultural psychology encouraged me to undertake a year-long Psychology honors thesis in which I investigated potential cultural differences in the effectiveness of 12 happiness-inducing techniques. My findings may lead to a fuller understanding of the relationship between cultural variables and ways to increase happiness.

The Person-Activity Fit Diagnostic (PAFD) is an instrument created by Lyubomirsky and Sheldon (2007) that briefly describes 12 empirically-validated happiness-increasing techniques. Respondents rate each technique in terms of five dimensions including naturalness, enjoyment, and value. Lyubomirsky and Sheldon recommend that individuals use their four highest-rated techniques. This is based on the premise of "self-determined motivation," that we are more inclined to do something if it seems natural and enjoyable to us--and less inclined if we feel pressured to pursue an activity (Lyubomirsky & Sheldon, 2005).

Past research indicates the existence of gender differences in how participants rate the PAFD techniques, which suggests the possibility of cultural differences as well. I predicted that persons in collectivist societies may fit better with activities like "Nurturing Social Relationships," whereas persons in individualistic societies may fit better with "Committing to Your Goals," because collectivist societies emphasize relatedness and individualistic societies emphasize personal achievement.

I recruited 150 participants from the (individualistic) United States and 150 participants from (collectivist) India through Amazon's Mechanical Turk. Participants completed the PAFD to determine the happiness-inducing techniques that will likely work best for them. They also completed a measure of religiosity and the INDCOL scale, which assesses individualist and collectivist values.

In my presentation, I will present the results of my cross-cultural survey. Specifically, I will examine the statistical relationships between four predictor variables--nationality, collectivist values, religiosity, and gender--and participants' utility ratings of 12 happiness-increasing techniques.

Sponsor: Pablo Toral

Link to Presentation

Kaveri Sarkar '20

New Delhi, India

Majors: International Relations; Psychology

Role of religion in narratives of nationhood and the rising tensions between Hindus and Muslims in India

As part of my International Relations senior seminar thesis, I examine how the role of religion in narratives of Indian nationhood has led to the ever-increasing rise of religious tensions between Hindus and Muslims from 2015 to 2020 in India. I review three theoretical approaches to nationhood--primordialism, modernism, and ethno-symbolism--to conceptualize Indian nationhood. Primordialism considers nations to have been present in different epochs of human history as it conflates *ethnies* with nations. Modernism, on the other hand, views nations to be more recent, and epiphenomenal to the processes that led to the period of modern development. Ethno-symbolism uses historical, cultural, and sociological lenses to offer an approach that combines the previous two to show that nations are essentially ethnic groups that over time become nations through social processes.

My research methodology relies on discourse analysis of narratives of nationhood --shared traditions, symbols, myths-- that a social group can derive a sense of belonging and identity from. I pay close attention to key events that are interpreted as symbols of religious nationalism today in these narratives. These events include colonial British rule prior to Indian independence in 1947, the Partition of 1947, the rise of Hindu

nationalist groups, featuring of the Hindu epic Ramayana on state television channels, the Babri Masjid (mosque) demolition, and the role of the current government in power. Religious tension is operationalized in terms of inter-group violence, physical and verbal, with data collected from political and public forums.

Sponsor: Kristin Labby
Choi-Fong Cho, Ph.D (Brigham and Women's Hospital)

Link to Presentation

Benjamin Scott '20

Carlsbad, California

Major: Biochemistry

Blood-brain barrier spheroids and 3D-printed perfusable chips as in vitro screening platforms for brain-penetrating agents

The blood-brain-barrier (BBB) is a major roadblock for therapeutic delivery to the central nervous system (CNS) in treating neuro-pathologies. *In vitro* models of the BBB are critical tools for the study of BBB transport mechanisms and development of drugs that can reach brain tissues. Current models of the BBB are proving more and more difficult and costly. Reproducibility of BBB properties and functions, in cultured brain endothelial cells, has proven to be challenging, and animal experiments are costly, laborious and could confer interspecies variations. The need for effective, functional, and cost effective BBB *in vitro* models is critical for the development and rapid testing of CNS therapeutics. BBB organoid spheroids and 3D-printed perfusable chips are two newly developed BBB models that create both optimal *in vitro* settings at a low cost. BBB organoids are spherical structures made up of human astrocytes at the core and human brain vascular pericytes and human brain endothelial cell outer layer. The grouping and ordering of cells constitutes a "blood-brain barrier" that displays physiological features in an *in vitro* setting. BBB organoid spheroids provide a route of analysis to measure a penetration agent's ability to successfully cross the BBB. 3D-printed perfusable chips are created by a bio-printer that is capable of dispensing cells and hydrogel materials at a nanodrop level with micrometer accuracy. Collagen hydrogel is used as a scaffolding to build up the chip and create channels within the chip. The function of the collagen is to allow for cell growth within the chip and the channels are used to pump fresh nutrients into the chip, thus, creating a vascular like environment. The creation of a vascular BBB environment allows for study of therapeutic travel in the bloodstream. Results show how the development of both models is progressing and what features each model displays.

Sponsor: Kristin Bonnie
Colleague: Rebecca K, Geometry teacher (a High School in Wisconsin)

Link to Presentation

Colleen Marie Tillis '20

Egg Harbor, Wisconsin

Majors: Psychology; Education & Youth Studies

Identifying Visual Spatial Weakness in Geometry Students

Completion of high school Geometry class is not only a rite of passage for adolescents today, but it is a required class of students who are college-bound or planning careers in the military, the trades, or design. A student's success or lack-there-of in Geometry can have lasting impacts on self-esteem and career opportunities.

Research shows that students who present visual spatial weaknesses will struggle in Geometry; yet, schools do not screen students for this difficulty. As a result, often, teachers and parents (and students themselves) are shocked and confused when the hardworking student struggles in a sophomore-level mathematics course. Generally, Geometry teachers are not introduced to evidence-based strategies designed to help these frustrated learners.

Drawing on my interests in Psychology and Education, I recruited and partnered with a Geometry teacher and eleven of her students in a Wisconsin high school to determine whether a relationship exists between the high schoolers' scores on psychological screening tests (designed to assess weaknesses in their visual spatial perception) and grades they earned in Geometry class.

Specifically, I aimed to determine which of six psychological tests -- the clock drawing test, the draw interlocking pentagon test, the Design Organizational Test (a pattern recognition test), the Trail Making Test A (a

connect-the-dots test using numbers), the Trail Making Test B (a connect-the-dots test that alternates dots between numbers and letters), or the cube drawing test –- are most predictive of students' grades. These screening tests are all quick, easy-to-administer, and require only pencil and paper. Grades were reported directly from the students' teacher, with permission from the students and their parents.

Although additional research is needed, studies like this can offer an evidence-based intervention that teachers can use on day one of Geometry class to identity students at risk for poor performance. Proactive tutoring and special programming can follow.

Sponsor: Catherine Orr

Link to Presentation

Sophia Townsend '20

Seattle, Washington

Majors: Psychology; Critical Identity Studies

Leaving Suburbia: an examination of white escapism in punk music

Leaving Suburbia is a year long research project which examines themes of white escapism outlined in punk rock. This project specifically looks at the band Green Day and their 2004 album American Idiot as a primary example of leaving suburbia functioning as a means of white punks trying to escape or redefine what it means to be white in America. While this project is a smaller piece of a larger puzzle, in which themes of trying to redefine whiteness have existed throughout punk's history, it specifically looks at this notion of suburbia as it's discussed by Green Day and groups functioning alongside this example.

Sponsor: Eyad Said

Link to Presentation

Ha H Truong '22

Ho Chi Minh City, Vietnam

Major: Computer Science

Human Activity Classification Using Smartphone Sensors

As smartphones become a must-have item in our pockets, they also become an invaluable information source about our daily life. Being able to recognize human activities through smartphones' passive motions, for instance, is a solid foundation to analyze individuals' physical health, detect accidents, and even predict possible health risks. That task, however, is quite challenging due to the variations of motions belonging to the same action (resulting from the smartphone's position, the user's personal habit, the surrounding environment, and so on). My project aims to preprocess those noised motions from different users, find a pattern between them, and classify each to categories of common activities. By applying Decision Tree, Support Vector Machine, and Neural Network, I built 3 data mining models, compared the results, and analyzed factors causing the differences. All of my models are trained and tested on over 10,000 instances (each with a 561-feature vector and 4 more attributes) from "Human Activity Recognition Using Smartphones" - an experiment conducted in 2015 with 30 volunteers (aged 19 to 48).

Sponsor: Diep Phan

Link to Presentation

Jiho Wu '20

Seoul, South Korea

Majors: Quantitative Economics; Studio Art

Olivia Brimacombe '20

London, UK

Major: International Political Economics
Minor: Chinese (Mandarin)

Labor Market Effects on High School Graduation Rates in the US

Do lower unemployment rates and higher minimum wages decrease the high school graduation rate? We analyze how high school graduation rate is affected by the labor market, economy, education policy and expenditure, legislature control, and population composition with a state fixed-effects model. Our results provide no support that better labor market conditions influence students' decision to drop out and work.

Sponsor: Jingjing Lou

Tianzi Zhao '20

Major: Education and Youth Studies

Link to Presentation

Xinxiang, Henan, China

Sex education: Beliefs and Practices–A Case Study of China, USA and Sweden

Professor Janice Irvine from University of Massachusetts Amherst once said in her book *Talk about Sex: The Battles Over Sex Education in the United States*: “We have tried ignorance for a very long time and it’s time we try education.” She is referring to sex education in her comment. In reality, however, it has proved to be difficult. School has been a battle ground for any discussions about sex education, as conflicts happen when different ideas and beliefs are encountered at the site of school.

This paper aims 1) to better understand where the belief systems of the oppositions to sex education originated by tracing them back in history, and 2) to explore practices that work and can improve the current situations of sex education in general and in China specifically. In order to do so, through an extensive literature review, this paper starts by examining the theoretical, historical, and religious roots of beliefs behind the debates around the sex and sexuality education topics. The paper will then compare and contrast the sex education practices of different countries that are considered to be largely affected by the belief systems discussed in the previous part. The paper concludes by discussing the inspiration drawn from the country case studies.

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