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### 2020 Inquiry Journal: Abstracts

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## ABSTRACTS FROM THE 2020 ISSUE

### *Research Articles*

#### **Using Magnetostratigraphy to Find the Cretaceous-Paleogene Boundary in La Colonia Formation, Patagonia, Argentina**



—Peter Haber (Mentor: William Clyde)

The Cretaceous-Paleogene (K-Pg) boundary is a geologic record that marks the occurrence of one of the most important events in Earth's history. At this time, approximately 66 million years ago, a mass extinction occurred, caused primarily by a meteorite impact. This also caused a change in global climate and widespread deposition of material ejected from the impact crater. Studying the K-Pg boundary can help us understand how Earth responds to catastrophic events. Currently, there are few continental records of the K-Pg boundary in South America, resulting in poor understanding of its effects there. One method for finding the boundary uses magnetostratigraphy (measuring the magnetic polarity of a rock, preserved from when it formed). Earth's magnetic field has reversed through time, and these reversals are recorded in rock formations. Chron C29r is an interval of reversed magnetic polarity that encompasses the K-Pg boundary. Samples taken from strata in La Colonia Formation in Patagonia, Argentina, were analyzed to find their magnetic polarity, resulting in the magnetostratigraphy for that formation. I successfully identified Chron C29r in samples taken from La Colonia. This information will help us better understand the mass extinction, especially how prevalent it was in South America and the extent to which biodiversity in that area suffered.

#### **Connecting Composting and Greenhouses: An Energy Capture and Usage Model**



—Dena Hoffman (Mentor: John Aber)

At the University of New Hampshire (UNH) Organic Dairy Research Farm in Lee, New Hampshire, I researched the practice of aerated static composting for potential heat capture. In early 2019, I created an Excel model to illustrate the ability of greenhouses to retain heat during a cold January and calculated the total energy balance for each day. This model shows that an average greenhouse, based on the dimensions of the greenhouse at nearby Kingman Farm, requires an additional, external heat source to supplement its heating needs during this time. By adding the heat generated by the aerated static composting pile to the greenhouse in the Excel model, we showed that the greenhouse could run on this heat alone, without the need for an external, nonrenewable source. UNH has the resources necessary to make this project come to life, and I believe that doing so would further our institution's achievements in sustainability.

## Professional Nurse-Led Unjani Clinics: Empowering the Nurse Entrepreneur



—Bri McGrath (Mentors: Gene Harkless, Lynda Toussaint)

South Africa, burdened by a wide wealth gap, meets the healthcare needs of the minority with health insurance but provides unreliable services for the uninsured. The uninsured clients suffer from long public clinic wait times and poor-quality care. The Unjani model was launched to provide high-quality affordable primary health care (PHC) to employed but uninsured families. Unjani aims to empower black women nurses as entrepreneurs and providers by providing them with shipping containers converted into world-class health clinics. Although nurses are central to the Unjani model, there is no published research describing their experience. I performed a qualitative study to identify the role of the nurse as PHC provider as well as facilitators and barriers to participating in the Unjani model. I conducted semi-structured interviews with ten Unjani nurses. I used thematic analysis to identify five themes. My results suggest that the Unjani nurses are invested, motivated, and proud to serve their community with a profit-generating high-quality PHC business. Furthermore, the Unjani model may be a powerful answer to global challenges in primary care access and quality.

## Contributing to the Field of Dam Removal Science: Analyzing Sediment Characteristics in Mill Pond and Sawyer Mill



—Hannah Miller (Mentor: Anne Lightbody)

Dams have served a vital role in American industry, providing flood control, irrigation, navigation, and hydropower. However, many of these dams no longer serve their initial purpose or are potentially hazardous to downstream communities because of aging infrastructure. Dam removals are becoming increasingly popular methods of reducing the risk of dam failure, restoring river ecological function, and eliminating long-term costs associated with maintenance and repairs. Dams do more than just store water; as water approaches the impoundment area, its velocity is reduced, which allows suspended sediment to settle and accumulate in the impoundment area. Removing a dam allows some fraction of this sediment and any associated contaminants such as heavy metals, organochlorines, and polynuclear aromatic hydrocarbons to mobilize downstream. To protect aquatic life and river health, an analysis of the quantity and quality of impounded sediment is required before dam removal. My research characterized the grain size, organic matter fraction, and mercury content of sediment impounded at Mill Pond and Sawyer Mill. Understanding the relationships between these variables and their spatial distribution throughout an impoundment could reduce the number of samples required to characterize an impoundment before dam removal, as potential hot-spot areas can be identified and targeted for sampling efforts. Though my results displayed no statistically significant relationships between variables, discovering mercury content levels of close to 4,000 parts per billion in fine-grained sediments at Mill Pond displays the need for such research.

## Media, Gender, and National Identity in Almaty, Kazakhstan



—Darby O'Neil (Mentors: Svetlana Peshkova, Nurseit Niyazbekov)

Kazakhstan is the largest country in central Asia, in terms of both land size and economy. Historically, Kazakhstan was a nomadic society with gender roles based on gendered division of labor. But throughout three centuries of colonial rule, first by Imperial Russia and then by the Soviet Union, Kazakh society and gender roles were transformed by various colonial policies. After the Soviet Union collapsed in 1991, however, Kazakhstan was suddenly an independent country and was faced for the first time with creating a unique national identity and idea of what it means to be Kazakh. This has led the Kazakh government to adopt a policy of idealizing and revitalizing nomadic Kazakh culture, which has served to revive old, nomadic gender roles. Through content and discourse analysis of the mediascape of Almaty, Kazakhstan, I learned about the current gender roles as they are portrayed in Kazakh media and analyzed how those roles are connected to the Kazakh government's policy of national identity building through the revival of ancient Kazakh nomadic norms.

## The Post-Tonal Pedagogical Piano Music of Dianne Goolkasian Rahbee



—Annelise Papinsick (Mentor: Rose Pruiksma)

Despite the rise of post-tonal music—music that doesn't follow the conventions of tonal music established between 1600 and 1900—there are relatively few teaching tools for introducing young and beginning piano students to this style of music. One composer of pedagogical post-tonal piano music is Dianne Goolkasian Rahbee. This project examines Rahbee's music and what students can gain from practicing and playing it, as well as the importance of female composers. My analysis of Rahbee's scores brought attention to a valuable collection of underrated pieces with a distinctive, folk-influenced aesthetic.

## Clothing and Power in the Royal World of Catherine of Aragon, Anne Boleyn, and Elizabeth I)



—Niki Toy-Caron (Mentor: John Cerullo)

In 1509, Henry VIII began one of the most infamous reigns of English history. It is not for his brilliant mind or his musical talent that he is remembered, but for his many wives. Because he could not get the divorce he needed from the Catholic church, Henry VIII, once named Defender of the Faith by the Pope, broke with the Catholic Church in 1533 and created the Church of England, with himself as head. Although Henry forced his will against the most powerful religious institution of the time, the women at the heart of the dispute had very little power over their circumstances. What power they did have they exercised through clothing and fashion. In this article I discuss my research into how Henry's wives and daughters used clothing to successfully negotiate the court. These women used clothing to advance their agendas, form their own alliances, and defend their interests. My research demonstrates how three of these powerful women used clothing for power in a time when even women in positions of power had little influence over their circumstances.

## Remote Sensing for River Restoration and Dam Removal Studies



—Bonnie Turek (Mentor: Kevin Gardner)

Inspired by the influence of drone applications in scientific research, my Summer Undergraduate Research Fellowship (SURF) study aimed to improve the accuracy of riverine topographic modeling by testing the use of terrestrial and submerged aquatic ground control points (GCPs) in drone surveys of the Bellamy River Reservoir. Accurate mapping of riverscapes is critical to investigations of before-and-after management activities, such as dam removals, and to better understanding topographic features created by physical, chemical, and biological processes in rivers and watersheds. These studies build on our increasing understanding and quantification of the cycling of chemical and biological substances in rivers and the valuable ecological services that watersheds provide. The evolution of remote sensing, drone technology, and digital elevation models provide an alternative to conventional, labor-intensive ground survey measurements and are of increasing importance for creating topographic products valuable to studies of riverscapes and watershed processes. Land-based GCPs are routinely used to develop highly accurate models; however, in rivers we seek to accurately measure submerged topography, which has been done only in limited environments because of numerous technical challenges. Incorporating submerged GCPs into drone workflows may be a simple yet effective way to improve in-stream topography models. Results of this study are expected to contribute key information for restoration planning for rivers and other aquatic habitats and studies of land use and impacts of human infrastructure, especially dams, in the hopes of creating and maintaining a more sustainable relationship with our natural environment.

## Living in a World Where Seeing Is No Longer Believing: Artificial Intelligence as a Disinformation Engine



—Dylan Wheeler (Mentor: Nick Smith)

With the help of my mentor, Professor Nick Smith, during the summer of 2019, I researched how new developments in artificial intelligence are enabling the mass manufacture and distribution of fake news. Looking specifically at deepfakes, a form of fake news that uses picture-perfect face swapping, I examined how new computer software makes it trivial for anyone in the world to manufacture disinformation, false information spread deliberately to deceive the masses. I believe that, if we are not careful, we could enter a post-truth future, where the truth about issues becomes overshadowed by emotionally charged headlines and discourse. With few ways to determine which images and videos have been synthesized, the most sensationalist news will attract the most attention. In my research paper, I outlined the problems we are facing, dove into the algorithms that make them possible, and offered recommendations for how our society can overcome the challenges ahead. I am extending my Summer Undergraduate Research Fellowship through my senior thesis in philosophy, where I am digging deeper into the epistemological issues of trusting the media in our modern world.

## Commentaries

### Growing as an Undergraduate Researcher and the Benefits of Directed Research



—Jake Gehrung (Mentors: David Clarke, Shadi S. Atallah, and Rommel Montúfar)

Research ventures have proven beneficial for society as whole, producing a plethora of results and findings that have improved our understanding of our planet and beyond. The number of opportunities for undergraduate students to get involved with research is growing, but the structure and expectations of these opportunities vary. It is important for students and mentors to recognize the most efficient course of action for novice researchers. As an experienced undergraduate researcher, I can attest to the variety of opportunities available and the chronology in which they should be pursued. I completed a water systems research project as a sophomore, a restoration directed-research project as a junior, and an environmental economics research fellowship as a senior. It is clear to me now that a directed-research project would have been the best way to start as a researcher. A directed-research project emphasizes the collaboration of a student team with a research mentor who offers fundamental guidance in the research process. Collectively, it is the most efficient way for a novice researcher to develop core research skills, focusing entirely on fundamental techniques without the expectations of advanced research. With the support and guidance offered by directed research, an aspiring researcher can make early strides in meeting their full potential. With this experience, such a student could move swiftly into advanced research as early as their third year of college. Given that young researchers are the future of science, investing in their development should be a priority, and I believe that directed research presents an amazing opportunity to make it one.

### Can Utilitarianism Improve the US Criminal Justice System? An Evaluation of Punishment and the Utility Calculus



—Piper Gibson (Mentor: Nick Smith)

During the summer of 2019 I had the opportunity to participate in the Research Experience and Apprenticeship Program (REAP) under the mentorship of Professor Nick Smith at the University of New Hampshire. In this commentary I introduce the research I completed during this program. I discuss the philosophy of utilitarianism, which was first popularized by European philosophers Jeremy Bentham and John Stuart Mill during the late eighteenth and nineteenth century, and explore how their utility calculus can be used to justify and prescribe punishments. I criticize the utility calculus's reliance on standard sentencing and other logistical issues associated with the calculus. I evaluate hypothetical punishments that would be prescribed by the utility calculus, as well as the logistics and theory of the utility calculus, to determine if the utility calculus has a positive or negative effect on punishment. Instead of a direct implementation of the utility calculus into criminal justice systems, I recommend that implementing utilitarian values, such as minimizing retributivism and increasing holistic thinking when determining sentencing, would positively benefit criminal justice systems.

## Uruguayan Marijuana Decriminalization: Crime Rates, Support Levels, and Implications for the United States



—Emily Soule (Mentor: Mary Fran T. Malone)

This commentary describes selected results from a study conducted using self-reported crime victimization rates, levels of marijuana policy support, and demographic information collected from adult citizens of Uruguay. Surveys were performed by the Latin American Public Opinion Project. In 2013, Uruguay decriminalized marijuana and planned to create a state-run marijuana industry, which began sales in 2017. I found that levels of safety in one's neighborhood, both perceived and actual, remained the same throughout or did not correlate to the marijuana decriminalization process in 2013. I also found that those who reported having a close friend or family member who used marijuana had higher levels of support for the new legalization policy than those who did not.