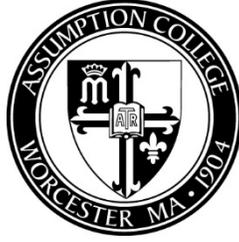


2020

ANNUAL **2** UNDERGRADUATE  
**SYMP 6<sup>TH</sup> SIUM**





## ASSUMPTION COLLEGE

### Office of the Provost and Vice President for Academic Affairs

This year, we recognize students who were originally scheduled to present their work at the 26<sup>th</sup> Annual Undergraduate Symposium. The Undergraduate Symposium is an event that highlights the research and scholarly achievements of Assumption students working in collaboration with dedicated faculty mentors. These collaborations represent a model for integrating teaching, original research, and the beneficial effects of peer review in promoting intellectual development and professional growth. The symposium provides the campus community with the opportunity to gain a greater appreciation of the individual and collective accomplishments of our faculty and students, as well as to applaud those achievements.

While an in-person event was not possible this year, I hope that you enjoy learning about each student project included in this abstract program. In addition, I invite you to visit the college website where a selection of posters and recorded oral presentations will be archived to commemorate the 26<sup>th</sup> Annual Undergraduate Symposium.

Sincerely,

Greg Weiner, Ph.D.  
Provost and Academic Vice President

# Undergraduate Symposium Spring 2020

## ABSTRACTS

**\*Student completed Honors Thesis**

### ***The Impact of Sleep Deprivation on Cognitive Performance and other Brain Functions***

Arshia Akhtar '20 Neuroscience

Sleep deprivation is one of the factors known to negatively impact cognitive functions. Studying neuroimaging and changes in hormonal levels helps us to better understand the response and the compensation mechanisms of the brain to sleep deprivation. We reviewed and investigated the different characteristics of sleep and its impact on specific cognitive functions. We took into consideration how these factors individually affect the cognitive functions and how they, in turn, contribute to sleep deprivation. We further hypothesize that sleep deprivation has a negative effect on emotional intelligence, perception, memory, and that sleep deprivation also affects other cognitive functions such as learning.

*Faculty Mentor: Dr. Nicolas Lessios-Damerow*

### ***Social Factors Related to Divorce***

Gabriella Bitar '20 Sociology & Criminology

The purpose of this research is to have a better overall understanding of divorce. The social factors that influence divorce may lead to a better processing and understanding of divorce in society. It may also lead to changes in the approach that attorneys use when dealing with clients. Divorce rates are constantly changing. Understanding what factors increase and decrease divorce will provide a better understanding of society and its cultural views. This relationship between social factors and divorce is currently being examined. These factors include gender, income, social class, age, and homeowner status. Past research supports that social factors have a strong influence on whether an individual is more likely to seek a divorce. Specifically, research has demonstrated a relationship between gender, income, and age, on divorce. However, the research conducted in this study examines a random sample of divorce-seeking clients to determine which of these social factors are prevalent throughout these individuals. Data was collected through the financial statements of individuals who are seeking a divorce. A content analysis was used to assess the data collected. Findings from the analysis support that the clients had a larger average income and age and were more likely to own a home in comparison to the general population. These results provide insight into the socioeconomic factors of the divorced population.

*Faculty Mentor: Dr. Walter Shelley*

### ***The Response of Murine Macrophages to Pathogen *Enterobacter aerogenes****

Nicole Bramlitt '21, Aleeza Isaac '20 Biology

Macrophages are a crucial part of the innate immune response as they are the primary phagocytotic cells, which means they are responsible for the engulfment and destruction of pathogens. *Enterobacter aerogenes* is a gram-negative facultative anaerobic bacillus that is frequently found in the gut and is considered a human pathogen. This study investigated the response of a murine-derived macrophage line (RAW 264.7) after being challenged with *E. aerogenes*. Multiple cellular and biochemical assays established whether the macrophages phagocytose, chemotax, secrete cytokines and produce reactive oxygen species. These experiments will allow us to better understand how the innate immune response targets a specific bacterial pathogen.

*Faculty Mentor: Dr. Aisling Dugan*

### ***The Significance of Transmedia Storytelling in the World of Jane Austen***

Margaret Brennan<sup>‡</sup> '20 English

Jane Austen's work has a history of being adapted, and the Emmy Award winning YouTube series *The Lizzie Bennet Diaries* is a transmedia adaptation of Austen's *Pride and Prejudice* meant to fulfill modern narrative desires. Through a focus on redeeming and rewarding the female characters, as well as an insistence on the platonic and familial relationships carrying more narrative weight than the central romance that drove the original novel, *The Lizzie Bennet Diaries* functions as an overtly feminist retelling of Austen's work. The series also provides metacommentary on the use of technology via the transmedia structure, posing questions towards the ethics of sharing details online without someone's consent, the interplay between a creator and their audience, and the immersive nature of storytelling across different media platforms.

*Faculty Mentor: Dr. Rachel Ramsey*

### ***Developmental Care in the NICU: Best Practices for Preterm Infants, Expectations of Healthcare Providers, and Impact on Parents and Families***

Alicia Burrows<sup>‡</sup> '20 Psychology

Infants born prematurely suffer from a variety of medical complications, which can impair their growth and development. Neonatal Intensive Care Units (NICUs) offer specialty units for infants born prematurely to receive medical care. A complementary form of care offered in some NICUs is developmental care, which focuses specifically on modifying the neonate's physical environment to ensure proper growth and development. In this project, the offerings of top U.S. NICUs were reviewed to determine their incorporation of developmental care. Additionally, NICU providers were interviewed to gather their opinions on developmental care and NICU care

in general. Results of these interviews indicated that while developmental care has proven to be very successful, it is not a standard of care in many NICUs and is not used as frequently as it should be. NICU providers also found that parents often suffer from a lack of support in the NICU. Through attending conferences on developmental care, NICU providers can encourage the use of developmental care in the NICUs that they work in. Additionally, engaging parents in developmental care and keeping them informed of their infant's treatment can help to offer them further support during their time in the NICU.

*Faculty Mentor: Dr. Alison Stoner*

### ***Self-Organization of Cosmic Elements During Stellar Evolution***

Travis Butler<sup>‡</sup> '20 Physics

An open question in science is how complex systems self-organize to produce emergent structures and properties. One aspect is to find the dependence of structure and organization on the size of a system. It has long been known that there is a quality-quantity relationship in natural systems; the properties of a system depend on its size. More recently, this relationship has been termed the Size-Complexity Rule. This work studies the average rates of nucleosynthesis and action efficiency of stars with varying initial metallicities and explosion energies from simulations based on the Stellar Abundances from the Galactic Archaeology database. This study looks at the size-complexity relation in stars of varying metallicities and explosion energies and to compare them with other complex systems. The grouping and number of reactions of nucleons into heavier elements are used as a measure of complexity of a star, because they increase the variety of elements and changes the structure of the star. The average rate of grouping of nucleons is calculated by multiplying each of them by their level of grouping, defined as how many of them are joined into a nucleus, and then divided by the lifetime of the star over which these isotopes were synthesized. As seen in previous work, complexity, as measured by action efficiency, grows exponentially in time and as a power law of all other characteristics of a system, including its size. Here it is found that the complexity of a star in terms of groupings of its elements and the rate of increase of complexity is a power law of its size despite differing explosion energies and initial metallicities. As shown by these stars, the bigger a system is, the higher the levels of complexity it can reach even if the initial metallicity and explosion energy are different. This is seen in how each star's progress, average rate of nucleosynthesis dramatically increases as a function of their initial number of nucleons. The goal is to find how universal the size-complexity relation is, and whether there are any exceptions. There are plans to study other systems to find whether they obey the same rule and, as stellar evolution simulations improve, to study in detail not just the average rate, but the instantaneous rate of nucleosynthesis.

*Faculty Mentor: Dr. Georgi Georgiev*

## ***Unpaid Stressors***

Hunter Davidson '20 Sociology & Criminology

The issue of security in the workplace is not one that is simply fixed by inserting security tags or cameras. The entire integrity of a workplace's foundation rests on the idea that a worker feels secure in their position and they are not a disposable cog in a machine. The purpose of this study is to ascertain a better understanding of employee's feelings about security in the workplace. The sample population are the staff from numerous retail-based institutions in the northeast. Interviews will be conducted in order to obtain this knowledge. The results are clear from preliminary research that many employees do not feel like they are being treated fairly and equally. This has major implications given the sheer number of Americans who work in retail and most likely feel the same way.

*Faculty Mentor: Dr. Walter Shelley*

## ***An American Crisis: An analysis of maternal mortality in the U.S.***

Emily Fernandes<sup>‡</sup> '20 Economics

Approximately 700 women die each year in the U.S from pregnancy related complications and over 60 percent of these deaths are preventable. The purpose of this research is to determine which risk factors, racial barriers, and pregnancy complications have a significant effect on the number of maternal deaths each year across U.S. states. A statistical model with ten variables was developed using state-level data on maternal mortality and health care factors including C-Section rates, prenatal care, maternal age, and race to determine which factors had a significant effect on the mortality rate. The model concluded that 50.8 percent of the variation in maternal mortality is explained by the variation of the independent variables. To reduce mortality rates, the U.S. needs to focus on increasing education and awareness, making improvements in hospitals and quality of care, establishing a national review board, and enacting legislature.

*Faculty Mentor: Dr. Colleen Fahy*

## ***The Ladder of Stress: Prosecutors' Attempts to Manage Stress and Emotion***

John Anthony Fine-Lease '20 Sociology & Criminology

Studies have shown that attorneys have increased stress levels compared to professions of similar education levels; this increased stress negatively impacts an attorney's well-being and ability to efficiently complete his or her job. However, few studies have researched the stressors of prosecutors, and more specifically, state-employed prosecutors. Within previous studies, this heterogeneous demographic does not give definitive data pertaining to the specific stressors and coping mechanisms of state-employed prosecutors. Furthermore, this research looks specifically at the variables of both age and experience when measuring state-employed prosecutorial stress, variables which previous studies have failed to disclose. Through semi-structured interviews, transcribing, and coding, this work was able to determine the most common stressors and coping

mechanisms among state-employed prosecutors, as well as further examining the effect age and experience has on stress level and overall well-being. Given the notion that state-employed prosecutors have the moral and societal obligation to reduce crime within each community, understanding the stressors of said individuals is inherently crucial. When state-employed attorneys practice unhealthy stress-coping mechanisms, for example, using alcohol and/or drugs, their inhibition and judgement is impaired, causing them to potentially reduce their effectiveness at completing their job. People should recognize the significance of this issue, in order to ensure the safety of every individual who enters the criminal justice system and the people they represent.

*Faculty Member: Dr. Walter Shelley*

### ***The Role of Depression and Family Expressiveness in Young Adults' Emotion Recognition***

Meghan Foster<sup>‡</sup> '20 Psychology

Young adults' ability to recognize others' emotions has been linked to their perceptions of family-of-origin expressiveness, though it is unclear whether depressive symptoms are associated with their family expressiveness and/or with their emotion recognition. Undergraduates' facial recognition of emotions, depressive symptoms, and family expressiveness were assessed. Findings indicated that greater negative family expressiveness was associated with depressive symptoms and less accurate emotion recognition, though positive expressiveness and depressive symptoms did not predict facial recognition.

*Faculty Mentor: Dr. Regina Kuersten-Hogan*

### ***The Effect of Integrin on Synaptic Development and Function***

Catherine French '20 and Alexis Nason '20 Neuroscience

Neurons transmit information throughout the body by communicating with other cells at specialized regions of communication, called synapses. The formation of these synapses is required for a functional nervous system. This research project built upon previous findings that demonstrated the requirement of integrin proteins, membrane receptors that bind to extracellular matrix molecules, in the proper development of GABAergic and cholinergic neurons. Our goal was to determine if integrins are present at synapses, which include a signal-sending side called the presynaptic compartment, and a signal-receiving side called the postsynaptic compartment. To learn if integrins are present in either or both of these synaptic compartments, we employed the genetically powerful model organism, *C. elegans*. This model is advantageous in these studies because of their fully mapped genome, short life cycle, and visual transparency. We developed novel transgenic strains of *C. elegans* that enabled us to view green fluorescent tagged integrin protein and a variety of red fluorescent labeled synaptic markers. By conducting genetic crosses, two novel transgenic strains were created and a third was nearly completed. One strain contained green fluorescent tagged integrin subunits and red fluorescent tagged postsynaptic markers in GABAergic neurons. A second strain contained green fluorescent tagged

integrin subunits and red fluorescent tagged presynaptic markers in cholinergic neurons. A third strain, which is close to completion, will contain green fluorescent tagged integrin subunits and red fluorescent tagged presynaptic markers in GABAergic neurons. In the future, fluorescent microscopy will be used to analyze these strains and learn if integrins may be present in presynaptic and/or postsynaptic compartments within synapses. This will be achieved by determining if green tagged integrins are co-localized with red synaptic markers. These studies ultimately will shed light on the location of integrin proteins, and this will help determine how integrins may shape synaptic development.

*Faculty Mentor: Dr. Michele Lemons*

### ***The Benefits of Mindfulness Meditation for College Students***

Hannah Fung<sup>‡</sup> '20 Psychology

Emerging adulthood, which spans ages 18 to 25, is a highly transitional time in a young person's life and can be a period of extreme stress and mental health challenges. It is uniquely important during this time period that institutions provide resources that support college students' ability to flourish. This study investigated the impact of mindfulness training on students' well-being as measured by mindfulness, meaning in life, perceived stress, self-compassion, flourishing, and GPA. Half of the participants received mindfulness training in an LLC interest circle. The other half was the control group and participated in an interest circle unrelated to mindfulness. Results revealed there was a significant interaction between meditation condition and time of testing on overall mindfulness. Surprisingly, students in the meditation group had lower levels of mindfulness at the end of the semester. Meaning in life, perceived stress, self-compassion, and flourishing did not change significantly from pre-test to post-test. However, significant positive correlations were found between outside practice time, nonjudgment of inner experience, and nonreactivity to inner experiencing, indicating that nonjudgment and nonreactivity increased with practice time. The results, which should be interpreted cautiously due to the small sample size, suggest that there may be promise in meditation training programs for those in this age group who are motivated to practice on their own.

*Faculty Mentor: Dr. Paula Fitzpatrick*

### ***Super or Sexist? The Evolution of Female Superheroes in Comics and Film***

Jordan Gablaski<sup>‡</sup> '20 English

The purpose of this study is to discuss and analyze how the graphic origins of three key Marvel and DC superheroines, Wonder Woman, Black Widow and Captain Marvel have limited the ways in which those same characters are represented in film today. The focus is first put on their origins in comics and their evolutions from the time periods in which they were created to today. These origins are then contrasted with current cinematic representations of the characters, analyzing how filmmakers struggle to create heroes that stay true to their origins, while accurately reflecting the public sense of what defines capable female role models in the

21st century. Have these incredibly popular characters, created in a time when stereotypes that limited women's abilities were prevalent and widely accepted, evolved to become vital and viable 21st century cinematic role models?

*Faculty Mentor: Dr. Becky DiBiasio*

### ***Unspoken Threat: The Age of Mass Shootings***

Noe Gaudette '20 Sociology & Criminology

Mass shootings are becoming a more constant problem within the everyday life of the American public and affecting the day to day activities of the workers of a concert venue. The rise of mass shootings can lead to an increase of anxiety and stress among the security members and staff of concert venues. This project seeks to understand how the employees of a concert venue in a large New England city think about mass shootings affecting their work place, the likelihood of it occurring, their overall feeling of safety and how the possibility of a mass shooting affects their mental and social behaviors. Data will be collected from a concert venue within a large New England city that puts on concerts consistently three to four times a week. The data will be obtained through a set of five interviews, each conducted with a member of the security staff from the concert venue taking about thirty to forty minutes per interview and gauging their thoughts on mass shootings occurring, and their relationships with fellow employees being a positive source of stress relief.

*Faculty Mentor: Dr. Walter Shelley*

### ***Mindset Matters: Using Research-Based Strategies to Enhance Middle-School Math Instruction***

Catherine Harvey<sup>‡</sup> '20 Education

Research suggests increased academic achievement in middle school students when they are pushed to develop a growth mindset in math. A growth mindset encourages students to believe their intelligence and academic achievement may be improved through hard work and effort. Students with a growth mindset seek academic challenges, embrace mistakes as opportunities to learn, and commit to a positive attitude regarding learning. As educators, we have an opportunity to develop growth mindsets by incorporating effective strategies such as using appropriate praise, encouraging mistakes, promoting resilience, and using diverse assessments.

*Faculty Mentor: Dr. Lisa D'Souza*

### ***Responding to an Increasingly Polylingual Society: An American Bilingual School***

Madeleine Iassogna<sup>‡</sup> '20 Human Services & Rehabilitation Studies

This thesis explores several causes for a current lack of language diversity in foreign language instruction in K-12 educational settings in the United States. In particular, the thesis focuses on our educational framework's historical foundation as one based on assimilation as well as a lack of focus on multiculturalism and interculturalism. This problematic dynamic has led

to little focus on foreign language education. This thesis will, therefore, focus on this sociocultural contextualization of language education, demonstrating the lack of focus on languages and its negative implications. In addition, there will be further research of an uncommon approach to language education, namely bilingual and polylingual programs, to demonstrate their efficacy and necessity in an increasingly global, polylingual, and transnational economy and world. Through interviews with bilingual educators, observations in intensive dual-language classes, and document analyses of a local bilingual program in Framingham, MA, this thesis aims to answer three qualitative research questions: how can a second language program thrive within a predominantly monolingual society? How do students from different backgrounds learn in linguistically diverse settings? and How do teachers make meaning of bilingual education?

*Faculty Mentor: Dr. Cinzia Pica-Smith*

### ***Growth Rate and Lipid Production in Extremophilic Algae***

Aleeza Isaac<sup>‡</sup> '20 Biology

Determining what conditions are most favorable to the growth and lipid production of specific algal strains can aid in the search for an alternative to fossil fuels. Desert and polar algae strains of the species that were grown on different nutrient-rich medias were tracked for their growth rates over a period of a month. Another experiment was conducted in which the same strains were frozen for a period of time and then harvested for their lipids. The cells underwent chemical extractions to isolate the lipids from the cells and the lipid content and composition was analyzed using a GC/MS. The results suggested that the polar strains grew best in nutrient-enriched media while the desert strains grew best in the media with less nutrients. Total lipid content increased in the desert strains and decreased in the polar strains.

*Faculty Mentor: Dr. Karolina Fučíková*

### ***An Investigation into the History, Science, and Future of Dental Filling Materials***

Natalia Kaczor<sup>‡</sup> '20 Chemistry

Dentistry has revolutionized from a form of ancient medicine to an expansive practice with many subdivisions. The first descriptions of cavities in history books date back to as early as 5000 BC and since then, the procedures and treatments for dental cavities have improved drastically. Current treatments of cavities include fillings with two common materials: dental amalgam or composite resins. There are pros and cons for each of the common filling materials including strength, durability, application procedure, and cost to the patient receiving the filling. These differences result in there not being simply one ideal current treatment for restoring dental cavities. However, new research suggests that dental stem cell regeneration may be the future of treating dental cavities. The purpose of this literary study was to determine if the quality of current filling materials should be improved or if researchers should proceed in the direction of regenerative dentistry for the restoration of dental cavities.

*Faculty Mentor: Dr. Benjamin Knurr*

### ***Precarity into Permanence***

Colleen Kurtz '20 Sociology & Criminology

Studies have shown that in order to discontinue the cycle of homelessness, individuals must be sufficiently educated and have a minimal level of resources to turn to in order to prevent them from returning to homelessness. This study examines how women utilize the resources of an emergency shelter and how the staff at the shelter perceive the use of the organization's resources, in addition to the process of transitioning the women into permanent housing. Through investigating the views of shelter services and resources from the perspective of the organization's staff and the women staying at the shelter, the most beneficial and attractive resources and support services can be understood. This study will also allow the women in distress to have a channel to express their experience with emergency services and can assist in the development of new policies and programs to allow for the most support and easiest transition into and out of emergency housing shelters and into permanent housing. Open life interviews will be conducted with the several staff members and several women utilizing the emergency shelter services. Given the immense population of homeless women and families in the city of Worcester, MA, this study can be seen as a driving force for policy change and increased funding to shelters and organizations to help these women in need receive the support and resources to transfer into permanent housing.

*Faculty Mentor: Dr. Walter Shelley*

### ***Policing and the Community: Is Communication the Key?***

Jason Lages '20 Sociology & Criminology

Policing in the community is something that has been a problem for many years. How much power do police officers really have and what defines abuse of power? From the other side, how are civilians supposed to interact with law enforcers? Studies that examine the communication or interaction of police officers with their communities have shown that police officers need to build and implement some key principles for encounters to become easier for both police and civilians. These principles are to treat people with respect, be neutral in their decision making, conveying trustworthy motives, and giving citizens a voice during the encounter (Bottoms & Tankebe, 2012). The issue of police communication with the public has become a big issue because of big events where police have been the perpetrators of abuse or misconduct. This has caused a distrust between communities and their police departments. The present work begins to examine whether the stigma and bad reputation between the two parties can shift if officers learn better communication skills and have more training on how to interact. The major focus should be communication. With better communication law enforcers will be able to do their job more efficiently. Interviewing from both sides, officers and civilians will give insight on the topic. This will be the beginning into researching how in some situations, communication is the key to better interactions and how this can better the efficiency of policing.

*Faculty Mentor: Dr. Walter Shelley*

## ***Uniting the Divided Soul: On Science and Philosophy***

Naheer Lahdo '20 Philosophy

Reason or Passion? Science or Philosophy? This paper highlights my years of research into the topic of anthropology and epistemology in underpinning what constitutes a human, and how to attain true fulfillment of that human. By studying philosophers from the Classical era to the Late Modern era, and also by reflecting on my own experiences at Assumption college, this work explores the rationale behind a strictly science versus strictly artistic education, the rejection of either lifestyle, and discusses the reasons why one must supplement themselves with both disciplines to lead a truly accomplished life. The reasons to live a life in any individual discipline seem to undermine themselves and fall apart when put to scrutiny.

*Faculty Mentor: Dr. Christian Göbel*

## ***These Kids are Set Up for Failure when they are Born***

Matthew Lonardo '20 Sociology & Criminology

Low parental monitoring, poor and low neighborhood opportunities, along with low socioeconomic status are the major factors causing an individual to engage in selling drugs (Little and Steinberg 2006; Vaughn 2011), but little work has been done throughout the last decade to see if these factors have changed or if there are new factors present. Individuals who experience more than one factor are most likely to engage in the drug trade. This study examines the relationship between drug dealing and the factors that seem to drive individuals to sell them during this timeframe. The theoretical perspective Thoughtfully Reflexive Decision Making (TRDM), an offshoot of Rational Choice Theory, is utilized to examine the relationship between the factors and the choices individuals make to sell drugs, not only raises awareness on why individuals sell drugs, but it may also help drive rehabilitation methods instead of harsh sentencing for these individuals. To examine this relationship, I will be performing direct observations on search warrants, arrest warrants, surveillance stakeouts, and meeting with informants among a Drug Enforcement Agency in New England.

*Faculty Mentor: Dr. Walter Shelley*

## ***The Demands of Shift Work and the Effects Police Officers Face***

Juan Maderos '20 Sociology & Criminology

Studies have shown the difference between police officers' health before, during, and after they enter the police department can affect their overall health. This is due to working numerous hours that potentially lead to sleep deprivation, which might further hinder their ability to perform on the job. Thus, this reliance on shift work is problematic for police officers. The usage of surveillance could benefit the police department, while reducing the demands of shift work. A reduction in shift work would minimize the risk of health issues derived from working long shifts and night shifts that could lead to health issues, such as heart problems, weight gain, and sleep deprivation that negatively impact an officer's performance. Various

members from a police department in a Northeastern city will be questioned on their perceptions of health throughout their career. This work will be done by conducting participant observation and interviews.

*Faculty Mentor: Dr. Walter Shelley*

### ***Optimizing the Expression of Cellular Retinoic Acid Binding Protein Type 1 (CRABP1)***

Emma Magna<sup>‡</sup> '20, Alexandra Cabral '20 Biochemistry

The goal of this experiment was to express the *crabp1* protein. First, the blue script plasmid (pBS) was transformed into BL21 cells. A protein expression assay was used with IPTG to induce the expression of the *crabp1* protein. When coomassie stained SDS PAGE gels and western blots showed a decrease in expression, another route was taken by using glucose and temperature changes. When expression decreased after induction with these changes as well, another approach was attempted. *Crabp1* was amplified in the pBS plasmid using PCR. After being run on an agarose gel, the bands were then purified, and these samples were digested using restriction enzymes and ran on another agarose gel. Next *crabp1* was inserted into two new vectors: pET-15, and pRSF via ligation. These resulting vectors were then transformed into BL21 cells, and colony PCR was performed on some of the resulting colonies to determine if *crabp1* was successfully inserted.

*Faculty Mentor: Dr. Laura Marcotte*

### ***Executive Functions: The Key to Growth in Elementary School Students***

Kelly Martin<sup>‡</sup> '20 Education

Research-based strategies to support development of executive functioning skills have been found to promote academic success in elementary school students. This research explores the development and support of the following executive functions: attention, organization, response inhibition, emotional control, planning, prioritizing, time management, goal-directed persistence, working memory, task initiation, and mental flexibility. Additionally, interview data from five K-3 elementary teachers was analyzed to determine current approaches and barriers to supporting executive function development in elementary schools. Collectively, this research provides a comprehensive look at the role of executive functions in academic achievement, strategies for teaching executive function skills, and a glimpse of the current approaches used by elementary teachers.

*Faculty Mentor: Dr. Lisa D'Souza*

## ***Young Adult Financial Literacy and Its Underlying Factors***

Emily Meyers<sup>‡</sup> '20 Accounting

This thesis discusses the current state of financial education and young adult financial literacy in the United States. Financial literacy is the level of personal finance knowledge an individual requires to make beneficial financial decisions. The United States faces a financial literacy crisis in young adults evidenced by failing scores of assessments administered by the JumpStart Coalition, a leader in researching financial literacy in young adults. This thesis presents research and analysis of personal finance assessment scores from students of Franklin High School in Franklin, Massachusetts. Assessments were administered to personal finance, business, and history students. The majority of students failed the assessment, and this thesis explores possible factors explaining why.

*Faculty Mentor: Prof. Bryan Coleman*

## ***Understanding Police Misconduct***

Mitchell Kinney '20 Sociology & Criminology

In the world we live in today, police misconduct is hard to be missed in police departments. With social media, dash cameras and past police violence, the question bares, why does police misconduct occur and how do departments punish their officers? One of the issues that citizens face is an officer trying to take things into their own hands. Instead of following the rules, what they learn in the academy and actual policing, they try to take matters into their own hands by playing by their own rules. For part of my research I will be shadowing an officer in a small town in the northeastern part of Massachusetts. To find more information about this issue I will do content analysis, while studying numerous articles that will better elucidate this issue. In the study I intend to first, describe why police misconduct is prevalent in today's policing world and second, examine how departments handle cases of police misconduct.

*Faculty Mentor: Dr. Walter Shelley*

## ***The (Ab)Uses of CRISPR-Mediated Human Genome Editing***

Brooke Mullen<sup>‡</sup> '20 Biology

Clustered regularly interspaced short palindromic repeats (CRISPR) coupled with CRISPR-associated (Cas) proteins (CRISPR/Cas) are the adaptive immune system of bacteria and archaea. In 2013, the CRISPR system was repurposed to *precisely* modify, delete, or replace DNA sequences of virtually any organism. Since then, the system has taken the scientific community by storm, having both therapeutic and agricultural applications. Most recently, CRISPR-Cas9 has been used to accurately repair disease-causing mutations and thus prevent the inheritance of genetic diseases. Life-changing scientific discoveries are being made every day but, as with many new discoveries, comes the risk of harmful use. With each scientific breakthrough, scientists and nonscientists should come together to discuss the current state of research, expected future developments and their possible ramifications on society.

*Faculty Mentor: Dr. David Crowley*

***Integrins Regulate Motor Neuron Commissural Patterning  
in a Cell Specific Manner***

Emily Norman '20, Heather Bates '20, Devyn Oliver and Michael M. Francis  
Neuroscience

During development, neurons grow branches towards their final target destinations. If this growth process becomes disrupted, it can lead to complications in motor movements and behavioral deficits. We studied neurite outgrowth in the model organism *Caenorhabditis elegans* to observe this process in a mutant background. Similar to humans, neurites in *C. elegans* extend branches called commissures towards their targets. We studied commissural patterns in animals with a known mutation in *ina-1*, a known member of the integrin family, previously shown to be important for neuronal development and as an aid in cell adherence to substrates. We focused on commissures from two classes of motor neurons: GABAergic and cholinergic. We found that when integrin is not fully functional, commissural outgrowth is selectively disrupted. Specifically, we found there is a significant disruption of commissural patterning in GABAergic neurons but not in cholinergic neurons. It was somewhat unexpected to find that integrin is expressed in both classes. We then sought to determine if integrin has a temporal requirement to ensure proper outgrowth. We found that integrin appears to be equally important for pre and post embryonically born GABAergic neurons. In summary, integrins are important for proper commissural patterning in a cell specific manner.

*Faculty Mentor: Dr. Michele Lemons*

***A Review of Trauma in Students with Autism Spectrum Disorder***

Orsolina O'Neill<sup>‡</sup> '20 Psychology

This project served to investigate the links between childhood trauma and its presentation in individuals with autism spectrum disorder. In this study I examined literature surrounding first autism spectrum disorder, investigating the diagnostic criteria, history, symptoms, and treatment options. I then investigated the literature surrounding childhood trauma, finding information on various types, critical stages in childhood development, symptoms, and treatment options. From here I investigated the comorbidity of autism spectrum disorder and childhood trauma, reasons why a diagnosis of comorbidity is difficult, and possible treatment options for individuals who receive a comorbid diagnosis. This study bridges historical knowledge and new evidence surrounding autism spectrum disorder, childhood trauma, and comorbidity between the two.

*Faculty Mentor: Dr. Karen Lionello-DeNolf*

## ***Smoldering Fire with Black Smoke: How First Responders Cope with PTSD within a Culture of Masculinity***

David Ortiz '20 Sociology & Criminology

While policing is considered an incredibly stressful job, firefighting comes with its own stresses. Cardiac disease accounts for 45% of all firefighter fatalities, and 37% of all firefighters have PTSD. Some of these issues might stem from firefighters not willing to seek help with these issues due to masculine cultures. The purpose of this work is to explore the masculinities that are associated with PTSD and firefighting. Data will be collected via interviews and field observations from a fire department in the Northeast region of the United States. The firefighters will be at different points of their career (beginning, middle, and nearing retirement). This research could be used to help develop better plans in helping firefighters deal with PTSD and promote a better environment for them to seek help in dealing with the constant stresses of the career.

*Faculty Mentor: Dr. Walter Shelley*

## ***The Marketing of Fame***

Elizabeth Paquette<sup>‡</sup> '20 Marketing

Since 2007, Kim Kardashian has been persistently plastered on the front of magazines, television, and social media, and is still one of the most recognized celebrities in America. This paper analyzes her fame and how she manages to stay at the forefront of our media, and how other firms can adapt the same successful techniques she uses for their own marketing. To study this, a comprehensive literature review was performed to identify different aspects of her fame and marketing, such as cultural anthropology and social psychology. The research showed that Kardashian uses a variety of tactics in her marketing such as para social interaction, persuasion, meaning transfer, and strong branding through her social media and television show. This paper emphasizes the effectiveness of Kardashian's strategies and the impact they could have if utilized similarly by other brands.

*Faculty Mentor: Dr. Cary LeBlanc*

## ***Using Worms to Identify Genes that Promote Axon Regeneration***

Brendan Philippon '20 Biology

In humans, injured adult neurons do not repair themselves or regenerate; however, axon regeneration is possible in *C. elegans* worms. Using worms, axon regeneration and identify the genes responsible for promoting neuronal repair can be studied. The mutant worm strain, *XE1002*, was used because these worms are born with injured/damaged axons, and consequently, have uncoordinated motor behavior compared to wildtype. Under fluorescent microscopes, *XE1002* worms averaged a baseline of four fully complete, uninjured axons. By conducting EMS mutagenesis protocol on these worms, genetic mutations were introduced. Generations later, certain plates of worms no longer moved with uncoordinated motor behavior; they moved like wildtype worms. In addition, these same worms displayed an increase in fully

complete, uninjured axons. Two plates of worms averaged eleven complete axons (N=6), which was the highest number screened. Moving forward, these plates would be genetically analyzed to identify the genes that relate to the axon regeneration observed. Acknowledgements at UMass Medical School: Dr. Alexandra Byrne, Wenjia Huang, Victoria Julian, and Lauren O'Connor.

*Faculty Mentor: Dr. Michelle Lemons*

### ***Age Differences in False Memory***

Mia Rapoza<sup>‡</sup> '20 Psychology

After witnessing an event, a witness may be exposed to additional details about the event. These details can be inaccurate and delivered by a number of sources including other witnesses, law enforcement, and news reports. The purpose of this study was to examine how such post-event details can influence eyewitness memory reports, specifically when the post-event details are delivered by individuals from a social in-group or social out-group. Participants were young and older adults who were paired with a fictional partner. The fictional partner was manipulated to appear as a member of the same racial group or a different racial group. Participant and partner pairs completed a social memory task in which the partner introduced false information to participants, which ultimately negatively impacted their memory. Older adults were observed to have greater memory impairments compared to young adults. Racial group membership of the fictional partner did not impact memory. In addition, older adults scored lower on a measure of executive functioning compared to young adults.

*Faculty Mentor: Dr. Leamarie Gordon*

### ***Discrimination Damages Defendants: Prosecutors and Defense Attorney's Opinions that Control the Fate of Defendants***

Colleen Rauser '20 Sociology & Criminology

Lawyers, both prosecutors and defense attorneys, show some type of discrimination toward the defendant when they are working on a case, whether that discrimination be based on race, gender, social class, or the neighborhood that they live in, rather than the crime that they committed. The purpose of this research is to understand the unfairness that defendants face within the court system by prosecutors and defense attorneys so one can determine a solution that could allow for better treatment of the defendant when they are in the court's custody. This study examined prosecutors and defense attorneys within a courthouse located in a large city in central Massachusetts. A twenty-five-question survey was administered to the prosecutors and defense attorneys that work within the courthouse in MA and was analyzed to determine if they believe defendants experience discrimination in the courtroom. The results show that there is discrimination toward defendants, mostly imposed by prosecutors.

*Faculty Mentor: Dr. Walter Shelley*

## ***The Sports Industry: More Than Just Inequality and Conflict***

Anya Rochussen '20 Sociology & Criminology

The function of a professional sports hockey organization is complex with a generalized set of norms shaped both on and off the ice. Over time, gender inequality, abuse of power with potential criminal consequences, and relational conflict have been observed to be routine behaviors in a particular office atmosphere, not allowing those involved to perform to their most capable ability. The purpose of this research is to determine if any potential factors correlate with the breaking of norms in a local minor league hockey association. Some factors that will be looked at to reach a possible conclusion are gender inequality, relationships, roles, and responsibilities using a qualitative analysis of participant observations and semi-structured interviews. The acquired knowledge can provide information to top managers on the functionality of the business, allowing the appropriate changes to be made in order to allow for a safe and healthy work environment.

*Faculty Mentor: Dr. Walter Shelley*

## ***A Potential Role of Evolution in Shaping Modern Human's Behaviors and Morals***

Madeleine Sarner<sup>‡</sup> '20 Health Science

Between 8 and 6 million years ago there existed a common ancestor linking the human species with their great ape relatives. Following the arrival of this organism, a lineage of several different human species began to emerge around two to three million years ago in Africa. These species included Homo rudolfensis, Homo habilis, Homo ergaster, Homo erectus, Homo floresiensis, Homo heidelbergensis, Homo neanderthalensis, and Homo sapiens. By analyzing these species and the great ape relatives, it is possible to begin to investigate the potential role of evolution in constructing modern human behaviors and morals.

*Faculty Mentor: Dr. Steven Theroux*

## ***Relationship Between Media Exposure and Quality of Life***

Adriana Savage<sup>‡</sup> '20 Psychology

In our modern era of smartphones, widely accessible digital television, and social media, it can be easy to be frequently bombarded with news and other media content. This study collects correlational data between the amount and type of media consumption, and the quality of life of the participants, measured through positive and negative affect, perceived stress, and perceived quality of life. Data was collected through an approximately 20-minute online questionnaire and included questions regarding news consumption relating to the recent COVID-19 pandemic. Results are currently being collected and analyzed.

*Faculty Mentor: Dr. Sarah Rose Cavanagh*

***The Influence of Media on Fear, Hope and Propaganda in  
Orwellian Dystopian Fiction***

Anna Schroeder<sup>‡</sup> '20 English

In this thesis, I examine the primary, dystopian works of *1984* by George Orwell, *Fahrenheit 451* by Ray Bradbury, *The Hunger Games* trilogy by Suzanne Collins and *V for Vendetta* directed by James McTeigue. In comparing the propaganda techniques used in these works, I have come to the conclusion that the older works of Orwell and Bradbury differ in that they incorporate the propaganda of “card stacking” in order to manipulate the citizens of the dystopia through mind-control, whereas the newer works of Collins and McTeigue employ the same propaganda, yet use it in a way that enforces submission through fear. Further, I found in my analysis that the newer, primary works of Collins and McTeigue incorporate hope for a utopic future that is lacking in the older, dystopian texts. I then discuss the different reasons behind the shift in the dystopian narrative, considering historical implications as well as the establishment of the “critical dystopia,” as defined by Tom Moylan. Next, I consider how the development of complex media technology influenced the shift in dystopian propaganda and format. Finally, I come to the conclusions that new media, particularly the internet, is responsible for influencing the new authors of the critical dystopia in their incorporation of control through fear, as well as the idea that individuals may use media in order to inspire hope for utopia.

*Faculty Mentor: Dr. Kristen Carella*

***Good Cop Bad Cop: How Police Officers Maintain Authority  
While Providing a Service***

Jillian Shenian '20 Sociology & Criminology

Communities across the United States need routine opportunities for people to have dialogue with each other; more importantly with the police. Trust is impossible, and safety is compromised when communities experience unfair law enforcement. The purpose of this research is to learn about the different roles that police officers take on, and how they interact and engage themselves in the community in hopes of creating relationships. For this research, I will conduct semi-structured interviews and participant observations with police officers working in different departments at a large police department in a New England city. By opening a dialogue between citizens and police officers, both groups of people will benefit by having the opportunity to expand communication skills, build trust, and ultimately eliminate biases that community members may have toward police officers.

*Faculty Mentor: Dr. Walter Shelley*

***Different Conceptions of Liberty in Revolutionary America***

Jenna Smith '20 History

What is liberty? Liberty is one of America’s founding principles. In the Declaration of Independence, Thomas Jefferson termed it one of the “unalienable Rights” endowed on men “by their Creator.” But what was the “liberty” that the individuals in America were seeking during the era of the American Revolution? For many, it was the freedom from arbitrary or despotic control.

For some, it was the freedom to “pursue” various social, political, or economic rights and privileges and to choose on their own. And yet for others, it was to achieve a state of freedom from bondage. White men, married women, and enslaved peoples, respectively, expressed different conceptions of liberty in eighteenth-century America. Liberty is broadly considered a defining American feature, but not every group living in the American colonies and new nation sought the same kind of freedoms.

*Faculty Mentor: Dr. Carl Robert Keyes*

### ***Applied Science Writing with “The Assumption Scientist”***

Madison Soullier ‘20 Biological and Physical Sciences/Writing

The Assumption Scientist is an online magazine created in 2019 with a three-fold effect; 1. It gives a more permanent residence to the research conducted by science students; 2. It serves as a mediator between research data and the Assumption Science student body; 3. It provides an outlet for the students to experience a mock publication process. The magazine has developed into a more encompassing research experience, providing not only research articles, but Professor biographies about research interests/histories and article supplements. This presentation will overview progress and future plans, as well as advocate the importance of science communication.

*Faculty Mentor: Dr. David Crowley*

### ***The Challenges of American Education Reform: The Common Core Standards for School Mathematics***

Evan Sperlinga<sup>‡</sup> ‘20 Education

Although recent NAEP scores have shown a decline, it is still too early in the adoption of the Common Core Standards for Mathematics to place blame on the standards. Rather, researchers have identified many underlying factors that have delayed the full implementation of instruction that is consistently aligned with the Common Core. Some of these factors include the lack of professional development, support for teachers, and curriculum materials aligned to the new state standards. Studies have shown that negative public perception, created by politics, has ruined what the Common Core represents, and has turned the public eye against the standards. Teachers need a strong collection of materials that align with Common Core, as well as time to become more comfortable with the content they are expected to teach. Recent growth in professional development provide promise that NAEP scores may begin to trend in the upward direction in years to come.

*Faculty Mentor: Dr. Jessica de la Cruz*

## ***The United States Moral Obligation Through the World Affairs Council***

Michael Turaj '20 History

Anyone who travels in the United States can explore a vast number of historical sites and iconic monuments that celebrate America's founding principles of freedom and democracy. The question of what obligations come with this freedom have vexed thinkers, writers, and leaders throughout the nation's history, with some arguing that the United States ought to keep to itself and be isolationist in world affairs and other "Wilsonian" minded individuals arguing that America has a responsibility to make the world safe for democracy. I have had the unique privilege to intern at the World Affairs Council of Connecticut, be a member of the Worcester World Affairs Council, and attend the World Affairs Councils of America's National Conference in Washington D.C. All three experiences have led me to conclude, in contrast to the isolationist position, that America has a moral obligation to confront and solve critical world issues, including the spread of biological/chemical weapons, human trafficking and ongoing genocides. The image and morals that America preaches should be actualized to help solve pressing transnational problems. The best use of our freedom comes not only in helping ourselves, but also in helping others.

*Faculty Mentor: Dr. Deborah Kisatsky*

## ***Money, Manipulation, & Madoff:***

### ***What are Ponzi Schemes & How to Avoid Becoming a Fraud Victim***

Nicole Turgeon<sup>†</sup> '21 Accounting

Bernie Madoff operated the largest Ponzi scheme in history at roughly \$65 billion and defrauded 13,567 investors over the course of forty years causing mass financial devastation when his scheme collapsed during the stock market crash of 2008. Although numerous red flags were apparent throughout Madoff's reign as the King of Wall Street, many people were not educated enough about Ponzi schemes in order to catch these red flags until after the scheme fell apart. By using Madoff's scheme as a backdrop, the goal of this presentation is to educate listeners on the red flags and inner workings of Ponzi schemes so they will not fall victim to this type of investment fraud in the future.

*Faculty Mentor: Prof. Philip Benvenuti*

## ***Sexual Assault and Lack of Reporting***

Kathryn Witherwax '20 Sociology & Criminology

Girls and women experience sexual assault daily and often let their perpetrators walk free and continue to commit crimes because of a lack of reporting. The goal of this project and through research is to create awareness around the problem of rape, lack of reporting, and how many perpetrators are walking free because victims are afraid of retaliation. To attempt to collect information on this topic information will be gathered from a police department in a medium sized town in eastern Massachusetts by working directly with one of four detectives in the department. The methods will include content analysis from closed cases that my internship site

has kept on file for the past 20 years or newer. The future results will benefit by bringing awareness to the culture and negative impacts of rape and lack of rape report.

*Faculty Mentor: Dr. Walter Shelley*

### ***Stem Cell Therapy as an Alternative Treatment for Osteoarthritis of the Knee***

Jessica Wortham<sup>‡</sup> '20 Biology

Osteoarthritis is the most prevalent joint disease in the world with 21% of the United States population struggling from it. The typical treatment for end stage osteoarthritis is a total knee replacement. Knee replacements are not ideal as they leave many individuals in pain with a more sedentary lifestyle. Stem cell therapy could be a new treatment for osteoarthritis. The stem cells are mesenchymal stem cells which are taken from the individual's own body and then injected into the knee. While the mechanism is currently unknown, the injection appears to reduce the individual's pain and inflammation with some individuals exhibiting new cartilage growth. The recovery time for the procedure is only a few weeks compared to six months with a total knee replacement. Stem cell therapy for osteoarthritis is entering U.S. clinical trials this year to determine the correct dosage and type of stem cell for optimal results.

*Faculty Mentor: Dr. David Crowley*

### ***Measuring Social Synchrony in Young Adults***

Jessica Wornham '20 Neuroscience

Social synchrony is the coordination of behaviors of people during their social interactions. Successful social synchrony has been linked to higher levels of social rapport. College-aged participants completed social motor coordination tasks using pendulums and a handclapping game. Secondly, they engaged in a 10-minute conversation with their peer partner. Lastly, they filled out the Autism Spectrum Quotient (ASQ). The movements during the social motor coordination tasks and conversation were tracked and recorded to determine if synchrony occurred. The ASQ provided a measure of autistic traits. The pilot results suggest that in pairs in which one partner scored higher on autistic traits, the partner with higher autistic traits said fewer words during the conversation. In contrast, when partners were similar in autistic traits, one partner asserted themselves as dominant during the conversation. Social synchrony did occur during the social motor tasks and the conversation showing that spontaneous social synchrony does occur in young adults.

*Faculty Mentor: Dr. Paula Fitzpatrick*

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**Next year's Symposium will be held in  
April 2021**

***Please mark your calendars!***

“Certainty is a closing of the mind. To create something new you must have doubt.”

- Milton Glaser

